515-CD-001-003

EOSDIS Core System Project

Release A Availability Models/Predictions for the ECS Project

Final

July 1995

Hughes Information Technology Corporation
Landover, Maryland

Release A Availability Models/Predictions for the ECS Project

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Prepared Under Contract NAS5-60000
CDRL Item 088

SUBMITTED BY

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Preface

This document is a contract deliverable with an approval code 2. As such, it does not require formal Government approval, however, the Government reserves the right to request changes within 45 days of the initial submittal. Once approved, contractor changes to this document are handled in accordance with Class I and Class II change control requirements described in the EOS Configuration Management Plan, and changes to this document shall be made by document change notice (DCN) or by complete revision.

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Abstract

This Availability Models/Predictions report (CDRL 88, DID 515) presents the analytical results of the ECS required functional availabilities. These functional availabilities are calculated based on detailed hardware configurations presented at the Science Data Processing (SDPS)/ Communcations and Systems Management (CSMS) Segments Release A and Flight Operations Segment (FOS) Release A/B Critical Design Reviews (CDR). The models in this document use mean-time-between-failure (MTBF) and mean-time-to-repair (MTTR) inputs from the Reliability Predictions Report (CDRL 89, DID 516) and the Maintainability Predictions Report (CDRL 91, DID 518) respectively.

Keywords: Availability, models, prediction, mean time between maintenance (MTBM), mean-time-between-failure (MTBF), mean time to repair (MTTR), mean down time (MDT), switchover time (ST), redundant, duty cycle.

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Change Information Page

List of Effective Pages	
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Title	Release A Final Copy
iii through xii	Final
1-1 and 1-2	Final
2-1 and 2-2	Final
3-1 through 3-6	Final
4-1 and 4-2	Final
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Contents

4. ECS Functional Availability Requirements

5. ECS RMA Functional Descriptions and Block Diagrams

6. ECS Availability Math Models

7. ECS RMA Modeling Process

8. Summary Of ECS Availability Results

Figures

Tables

Appendix A. Availability Data Worksheets/Block Diagrams and Analytical Results

Abbreviations and Acronyms

1. Introduction

1.1 Identification

This Release A Availability Models/Predictions Report, Contract Data Requirements List (CDRL) Item 088, whose requirements are specified in Data Item Description (DID) 515/PA2, is a required deliverable under the Earth Observing System Data and Information System (EOSDIS) Core System (ECS), Contract (NAS5-60000).

1.2 Scope

This report is the updated version of the preliminary submittal which was generated at the ECS Release A Preliminary Design Review (PDR) time frame. This document provides assessments of the ECS and its Segment functional availabilities stated in the ECS Requirements Specification, 194-216-SE1-001. These assessments were based on analytical predictions and probabilistic determination of the ECS Hardware Configuration Items (HWCIs) as presented at the Release A Critical Design Review (CDR) time frame. These HWCIs represent the Flight Operations Segment (FOS) Release A/B configuration, the Science and Data Processing Segment (SDPS) and the Communications and Systems Management Segment (CSMS) Release A configuration. FOS Release A/B is only applied to GSFC site. The CSMS and SDPS functional availability calculations are Distributed Active Archive Center (DAAC) site specific. The applicable Distributed Active Archive Center (DAAC) sites for the Release A SDPS and CSMS are: Goddard Space Flight Center (GSFC), Marshall Space Flight Center (MSFC), and Langley Research Center (LaRC). ECS equipment provided at Earth Resources Observation System (EROS) Data Center (EDC) is for integration and test purpose only. The ECS Segment hardware configurations that are required to meet the functional availability requirements are Release A and beyond and only at the operational sites. These analytical availability assessments will be conducted and updated for each Release configuration or when there are changes made to ECS hardware configuration.

The availability modeling effort includes the development of hardware functional and reliability block diagrams or strings at each Segment and function in the ECS. Mathematical models were developed for each block diagram with the underlying ground rules and assumptions. The ECS availability models have been implemented on Excel 5.0 workbooks. These models consist of a series of linked workbooks and workbook pages that accept user's inputs, calculate individual equipment/subsystem availability, estimate overall functional availability, display the results in graphical and tabulated formats, and allow the exercise of "what-if" scenarios. This modeling process is described in details in Section 7.0 of the report. Analytical results for each required RMA functional string are provided in a spreadsheet format in Appendix A. The data required to perform the availability analyses were obtained from both the ECS Reliability and Maintainability Predictions reports, documents 516-CD-001-003 and 518-CD-001-003, respectively.

This document reflects the June 21, 1995 Technical Baseline maintained by the contractor configuration control board in accordance with the ECS Technical Direction No.11, dated December 6, 1994.

1.3 Purpose and Objectives

The purpose of this document is to present mathematical models and techniques applied by the ECS contractor to analytically demonstrate the ECS Requirements Specification compliance for all required functional availabilities. The modeling results are expressed in terms of Mean Time Between Maintenance (MTBM), Mean Down Time (MDT), and operational availability (A_O). The system availability modeling effort was initiated early in the ECS design phase and will continue throughout the operational phase to analyze effects of design changes occurring as a result of sustaining engineering activity, maintenance activities, or aging. Availability models will be updated with information resulting from reliability/maintainability predictions as well as design or operational changes (including any changes in mission parameters or operational constraints).

1.4 Document Status and Schedule

This submittal of DID 515/PA2 meets the milestone specified in the Contract Data Requirements List (CDRL) of NASA contract NAS5-60000. It is anticipated that this submittal will be reviewed during the Release A Critical Design Review (CDR), and that subsequent changes to the document will be incorporated into a resubmittal to be delivered two weeks after receiving comments from the customer.

Subsequent availability models/predictions updates for each release configuration will be submitted at each release Incremental Design Review (IDR), CDR, and throughout the ECS life cycle.

1.5 Document Organization

The document is organized into eight (8) sections and two appendices:

Section 1	Introduction, contains the identification, scope, purpose and objectives, status and schedule, and document organization.
Section 2	Related Documents, provides a bibliography of parent, applicable and information documents for the Availability Models/Predictions.
Section 3	ECS System Description, provides a brief ECS System overview and each Segment Hardware Architecture description.
Section 4	ECS Functional Availability Requirements, summarizes the ECS System Level as well as the Segment Level availability requirements.
Section 5	ECS RMA Functional Descriptions and Block Diagrams, describes each Segment functional availability requirement and their associated reliability block diagrams.
Section 6	ECS Availability Math Models and RMA Data Sources, describes the math models and the source of the RMA data to support the availability modeling effort.

Section 7	ECS RMA Modeling Process, describes the modeling process using Excel 5.0 workbooks with ground rules and assumptions that the models are based on.
Section 8	Summary of ECS Availability Results, presents the summary of all required functional availabilities by operational DAAC sites.
Appendix A	Availability Data Worksheets and Analytical Results, provides a complete set of Excel spreadsheets for all required RMA functions, the block diagrams and their availability/ mean down time results.

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2. Related Documentation

2.1 Parent Documents

The parent document is the document from which this Availability Models/Predictions document scope and content are derived.

194-207-SE1-001	Systems Design Specification for the ECS Project
420-05-03	Goddard Space Flight Center, Earth Observing System (EOS) Performance Assurance Requirements for the EOSDIS Core System (ECS)
423-41-01	Goddard Space Flight Center, EOSDIS Core System (ECS) Statement of Work
423-41-02	Goddard Space Flight Center, Functional and Performance Requirements Specification for the Earth Observing System Data and Information System (EOSDIS) Core System
423-41-03	Goddard Space Flight Center, EOSDIS Core System (ECS) Contract Data Requirements Document

2.2 Applicable Documents

The following documents are referenced within this Availability Models/Predictions document, or are directly applicable, or contain policies or other directive matters that are binding upon the content of this volume.

194-501-PA1-001	Performance Assurance Implementation Plan for the ECS Project
194-502-PA1-001	Contractor's Practices & Procedures Referenced in the PAIP for the ECS Project
516-CD-001-003	Reliability Predictions for the ECS Project
518-CD-001-003	Maintainability Predictions for the ECS Project
210-TP-001-002	Technical Baseline for the ECS Project
NPRD-91	Nonelectronic Parts Reliability Data 1991

2.3 Information Documents

The following documents, although not referenced herein and/or not directly applicable, do amplify or clarify the information presented in this document. These documents are not binding on the content of the Availability Models/Predictions document.

305-CD-001-002 & 311-CD-001-002	Flight Operations Segment (FOS) Design Specification and FOS Database Design and Database Schema Specifications, Final
305-CD-007-001	Release A SDPS Data Management Subsystem Design Specification for the ECS Project
305-CD-008-001	Release A SDPS Data Server Subsystem Design Specification for the ECS Project
305-CD-009-001	Release A SDPS Ingest Subsystem Design Specification for the ECS Project
305-CD-010-001	Release A SDPS Planning Subsystem Design Specification for the ECS Project
305-CD-011-001	Release A SDPS Data Processing Subsystem Design Specification for the ECS Project
613-CD-001-001	COTS Maintenance Plan for the ECS Project, Preliminary
MIL-STD-756	Military Standard: Reliability Modeling and Prediction
MIL-STD-785	Military Standard: Reliability Program For Systems and Equipment Development and Production, Task 201

3. ECS System Description

3.1 ECS Overview

The EOSDIS Core System (ECS) is the major component of the EOS Data and Information System (EOSDIS). The ECS will control the EOS spacecraft and instruments, process data from the EOS instruments, and manage and distribute EOS data products, other selected data sets and updated NASA/SPSO Product List Tables. Interoperating with other data systems maintained by government agencies and the research community, the ECS will provide comprehensive services for accessing Earth science data.

A goal of the ECS program is to provide a highly adaptable system that is responsive to the evolving needs of the Earth science community. Thus, the ECS will support the "vision" of an evolving and comprehensive information system to promote effective utilization of data for research in support of the Mission to Planet Earth (MTPE) goals.

The Earth Observing System includes NASA instruments on satellites to be launched by NASA, the European Space Agency (ESA), and the Japanese National Space Agency (NASDA). Figure 3.1-1 presents a view of the EOS Mission Components. Figure 3.1-2, EOS Mission Science Dataflow, provides a view of the flow of science data from these various platforms to the users. The ECS consists of the shaded portions of Figure 3.1-2, plus facilities for operation of the NASA EOS satellites and instruments, including NASA instruments on International Partner satellites. For detail description of these data flows, refer to the System Design Specification for the ECS Project, 194-207-SE1-001.

ECS is composed of three segments defined to support three major operational areas: flight operations, science data processing, and communications/system management. The following sections provide a brief description of these ECS segments.

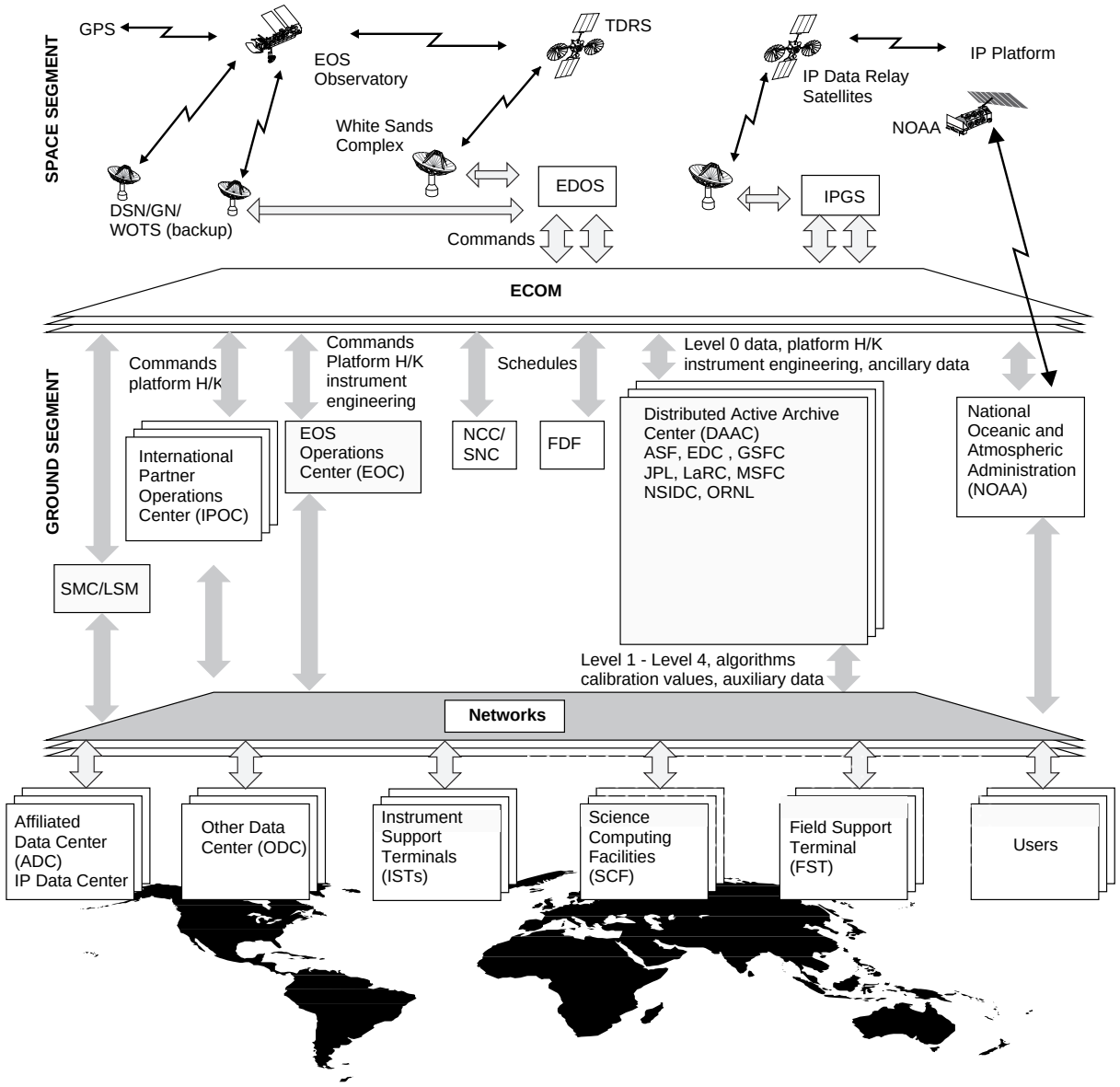

Figure 3.1-1. EOS Mission Components

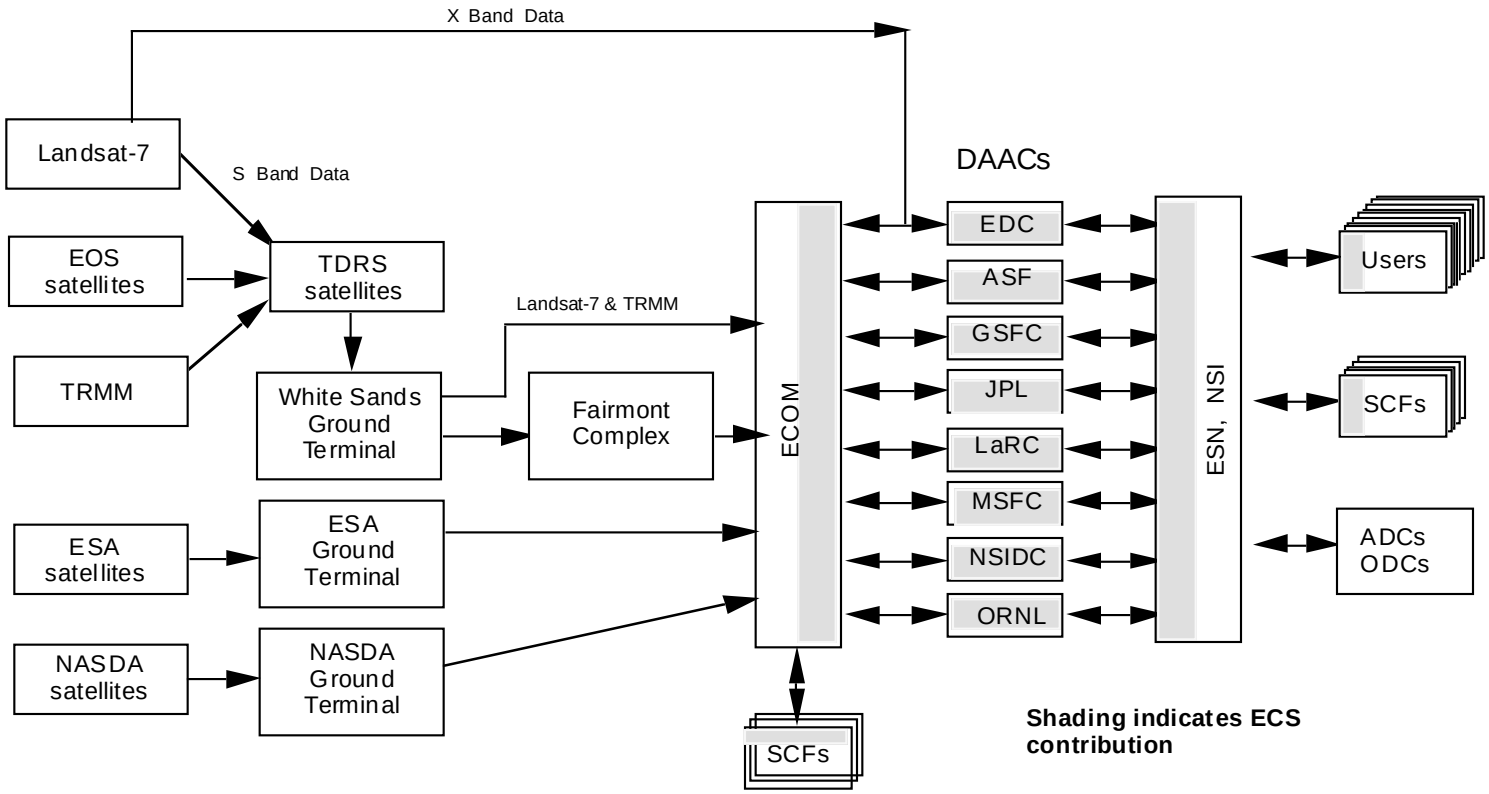

Figure 3.1-2. EOS Mission Science Dataflow

3.2 FOS Description

The Flight Operations Segment (FOS) manages and controls the EOS spacecraft and instruments. The FOS is responsible for mission planning, scheduling, control, monitoring, and analysis in support of mission operations for U.S. EOS spacecraft and instruments. The FOS also provides investigator-site ECS software (the Instrument Support Terminal (IST) toolkit) to connect a Principal Investigator (PI) or Team Leader (TL) facility to the FOS in remote support of instrument control and monitoring. PI/TL facilities are outside the FOS, but connected to it by way of the EOSDIS Science Network (ESN). The FOS focuses on the command and control of the flight segment of EOS and the interaction with ECS ground operations. For detail description of the FOS architecture, refer to the FOS Design Specification, document 305-CD-002-001. Figure 3.2-1 provides a block diagram of the FOS system architecture, which includes the FOS computers, networks, and peripherals.

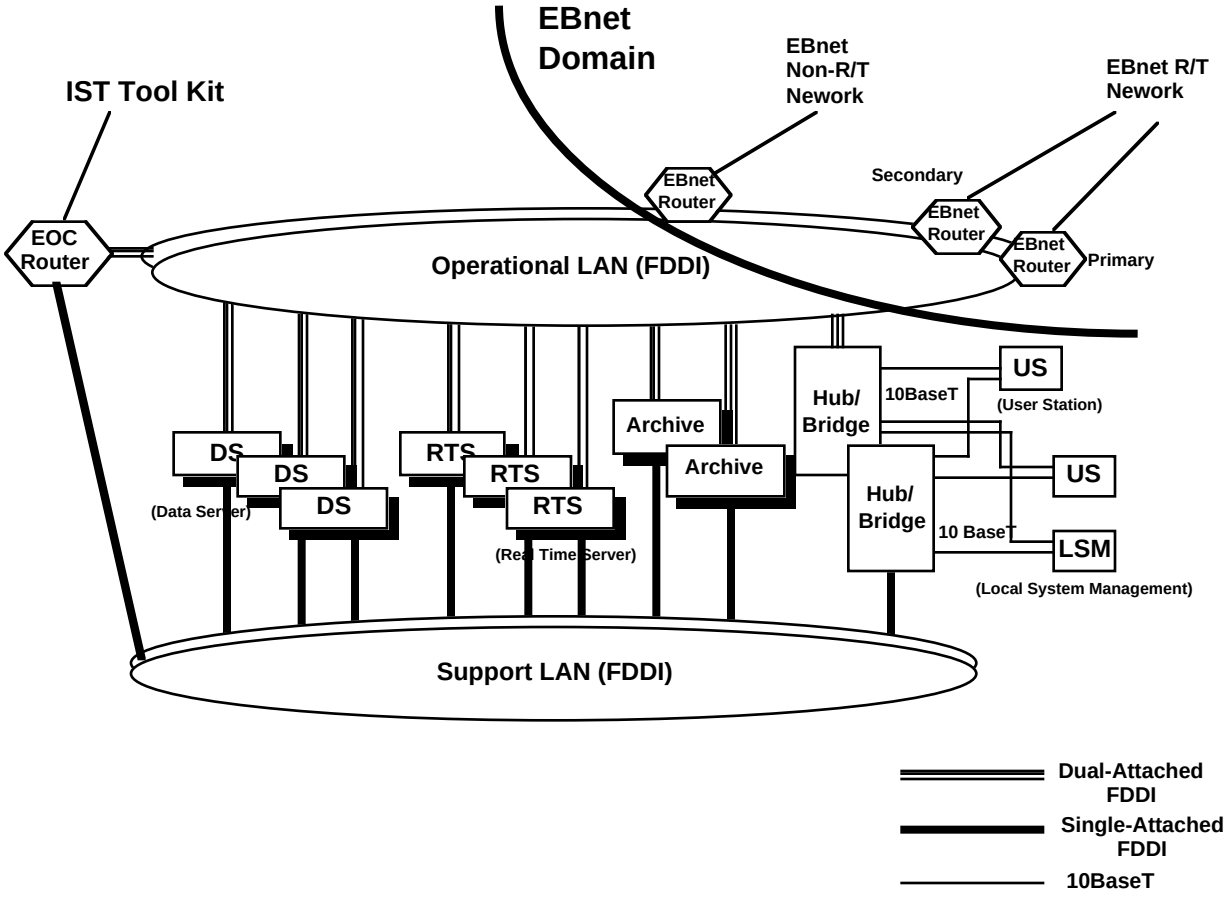

Figure 3.2-1. FOS System Architecture

3.3 SDPS Description

The Science Data Processing Segment (SDPS) receives, processes, archives and manages all data from EOS and other NASA Probe flight missions. It provides support to the user community in accessing the data as well as products resulting from research activities that utilize this data. SDPS also promotes, through advertisement services, the effective utilization and exchange of data within the user community. Finally, the SDPS plays a central role in providing the science community with the proper infrastructure for development, experimental usage and quality checking of new Earth science algorithms. SDPS is a distributed system and its components are currently located at eight Distributed Active Archive Centers (DAACs). For detail description of the SDPS architecture, refer to the SDPS Design Specification, document 305-CD-002-001. Figure 3.3-1 presents the SDPS/CSMS Release A hardware topology at the LaRC DAAC.

3.4 CSMS Description

The Communications and System Management Segment (CSMS) focuses on the system components involved with the interconnection of user and service providers and with system management of the ECS components. The CSMS is composed of three major Subsystems. They are the Communications Subsystem (CSS), the Internetworking Subsystem (ISS), and System Management Subsystem (MSS). The MSS, which includes several decentralized Local System Management capabilities at the DAAC sites and the mission operation center, provides system management services for the EOS ground system resources. The services provided by the MSS, even though they rely on the CSS provided services, are largely allocable to the application domain. For detail description of the CSMS architecture, refer to the CSMS Design Specification, document 305-CD-003-001. Figure 3.3-1 presents the SDPS/CSMS Release A hardware topology at the LaRC DAAC.

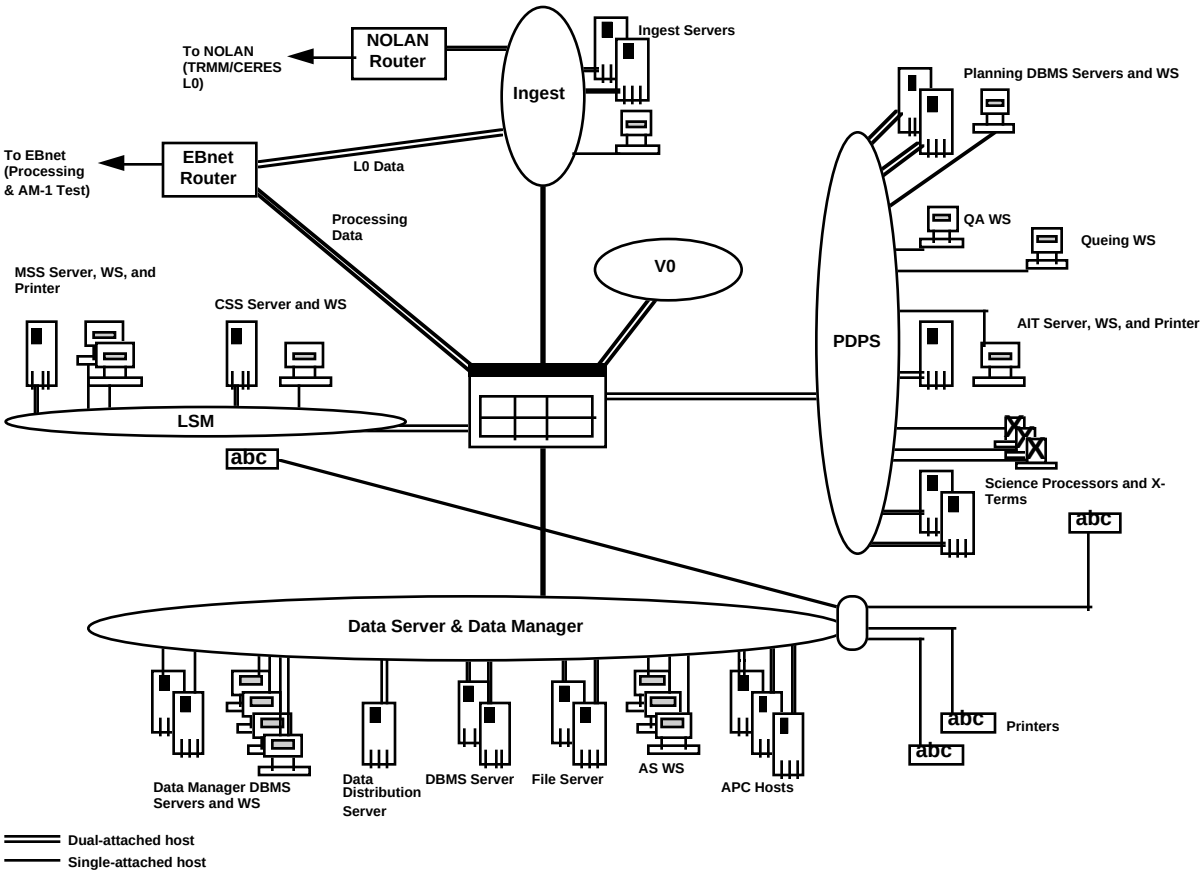

Figure 3.3-1. Release A LaRC SDPS/CSMS Hardware Topology

4. ECS Functional Availability Requirements

4.1 System-Level Availability Requirements

The ECS System-level quantitative availability requirement is as follows:

EOSD3700 ECS functions shall have an operational availability of 0.96 at a minimum and an MDT of four (4) hours or less, unless otherwise specified.

The above requirement covers equipment including:

a. "Non-critical" equipment configured with the critical equipment supporting the functional capabilities in the requirements

b. Equipment providing other functionality not explicitly stated in the following Segment-level availability requirements.

4.2 Segment-Level Availability Requirements

The following sections summarize the three Segments quantitative availability requirements of the ECS.

4.2.1 Flight Operations Segment (FOS) Availability Requirements

EOSD3800 The FOS shall have an operational availability of 0.9998 at a minimum (.99997 design goal) and an MDT of one (1) minute or less (0.5 minute design goal) for critical real-time functions.

EOSD3810 The FOS shall have an operational availability of 0.99925 at a minimum (.99997 design goal) and an MDT of five (5) minutes or less (0.5 minute design goal) for non-critical real-time functions.

4.2.2 Science Data Processing Segment (SDPS) Availability Requirements

EOSD3900 The SDPS function of receiving science data shall have an operational availability of 0.999 at a minimum (.99995 design goal) and an MDT of two (2) hours or less (8 minutes design goal).

EOSD3910 The switchover time from the primary science data receipt capability to a backup capability shall be 15 minutes or less (10 minutes design goal).

EOSD3920 The SDPS function of archiving and distributing data shall have an operational availability of 0.98 at a minimum (.999999 design goal) and an MDT of two (2) hours or less (9 minutes design goal).

EOSD3930 The user interfaces to Information Management System (IMS) services at individual Distributed Active Archive Center (DAAC) sites shall have an operational

availability of 0.993 at a minimum (.9997 design goal) and an MDT of two (2) hours or less (1.4 hour design goal).

EOSD3940 The SDPS function of Information Searches on the ECS Directory shall have an operational availability of 0.993 at a minimum (.9997 design goal) and an MDT of two (2) hours or less (1.4 hour design goal).

EOSD3960 The SDPS function of Metadata Ingest and Update shall have an operational availability of 0.96 at a minimum (.999999 design goal) and an MDT of four (4) hours or less (6 minutes design goal).

EOSD3970 The SDPS function of Information Searches on Local Holdings shall have an operational availability of 0.96 at a minimum (.999999 design goal) and an MDT of four (4) hours or less (6 minutes design goal).

EOSD3980 The SDPS function of Local Data Order Submission shall have an operational availability of 0.96 at a minimum (.999999 design goal) and an MDT of four (4) hours or less (6 minutes design goal).

EOSD3990 The SDPS function of Data Order Submission Across DAACs shall have an operational availability of 0.96 at a minimum (.999999 design goal) and an MDT of four (4) hours or less (6 minutes design goal).

EOSD4000 The SDPS function of IMS Data Base Management and Maintenance Interface shall have an operational availability of 0.96 at a minimum (.999999 design goal) and an MDT of four (4) hours or less (6 minutes design goal).

EOSD4010 Each computer providing product generation shall have an operational availability of 0.95 at a minimum (.9995 design goal).

4.2.3 Communications and System Management Segment (CSMS) Availability Requirements

EOSD4030 The SMC function of gathering and disseminating system management information shall have an operational availability of .998 at a minimum (.999998 design goal) and an MDT of 20 minutes or less (5 minutes design goal), for critical services.

EOSD4036 The operational availability of individual ESN segments shall be consistent with the specified operational availability of the supported ECS functions.

5. ECS RMA Functional Descriptions and Block Diagrams

5.1 FOS Functions

5.1.1 FOS Critical Real-Time Functions (EOSD3800)

FOS Critical Real-Time functions consist of Critical Command and Control Systems that provide functions to support the followings: launch, early orbit checkout, orbit adjustment, anomaly, investigation, recovery from safe mode, routine real-time commanding and associated monitoring for spacecraft and instrument health and safety.

For Release A/B, the FOS Critical Command and Control Systems that perform critical real-time functions consist of redundant groups of Real-Time Servers, Data Servers (for Events archiving function only), FOT (Flight Operations Team) User Stations, RAID (Redundant Array of Independent Disks) storage devices, Timing Systems and Hub/Bridge assemblies. The following Figure 5.1.1-1 shows the reliability block diagram of the FOS Critical Real-Time Functions with their associated hardware Commercial-Off-the-Shelf (COTS) Reliability, Maintainability, Availability (RMA) data. The reliability block diagram is a short hand graphical representation of all hardware and their configuration that required to achieve the function success. The block diagram displays the hardware configuration item (HWCI) description, redundant configuration and other pertinent RMA data of the HWCI such as availability, MTBF, MTTR, ALDT, etc. From this diagram, reliability models for the required function were developed to support the availability calculations. Detailed description of these models is provided in Sections 6.0 and 7.0, and their results are provided in Appendix A.

5.1.2 FOS Non-Critical Real-Time Functions (EOSD3810)

FOS Non-Critical Real-Time functions consist of the following hardware:

- The Data Server provides a focal point for performing non-real-time functions such as servicing requests for historical data (i.e., telemetry and event history data).
- The RAID Data Storage Unit provides the storage of FOS data locally. This includes the short-term telemetry housekeeping data and event history data, scheduling data, operational data, and data base files.
- Laser printers, color printers and line printers are connected to the EOC network enabling access by any EOC computer.
- A time server provides an external clock source to ensure the resolution and accuracy of the computer time.
- Hub/Bridge assembly provides communication interfaces with the Local Area Networks (LAN).

Figure 5.1.2-1 shows the reliability block diagram of the FOS Non-Critical Real-Time Functions with their associated COTS RMA data. From this diagram, reliability models for the required function were developed to support the availability calculations. Detailed description of these models is provided in Sections 6.0 and 7.0, and their esults are provided in Appendix A.

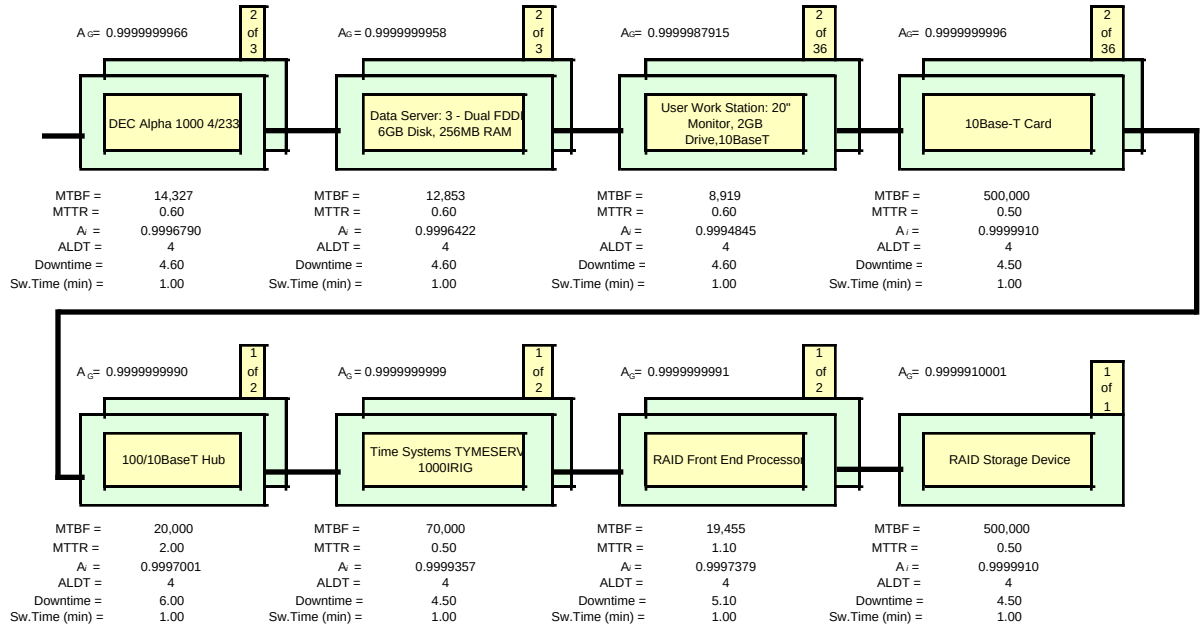

Figure 5.1.1-1. Release A/B FOS Critical Real-Time Functions Hardware Reliability Block Diagram

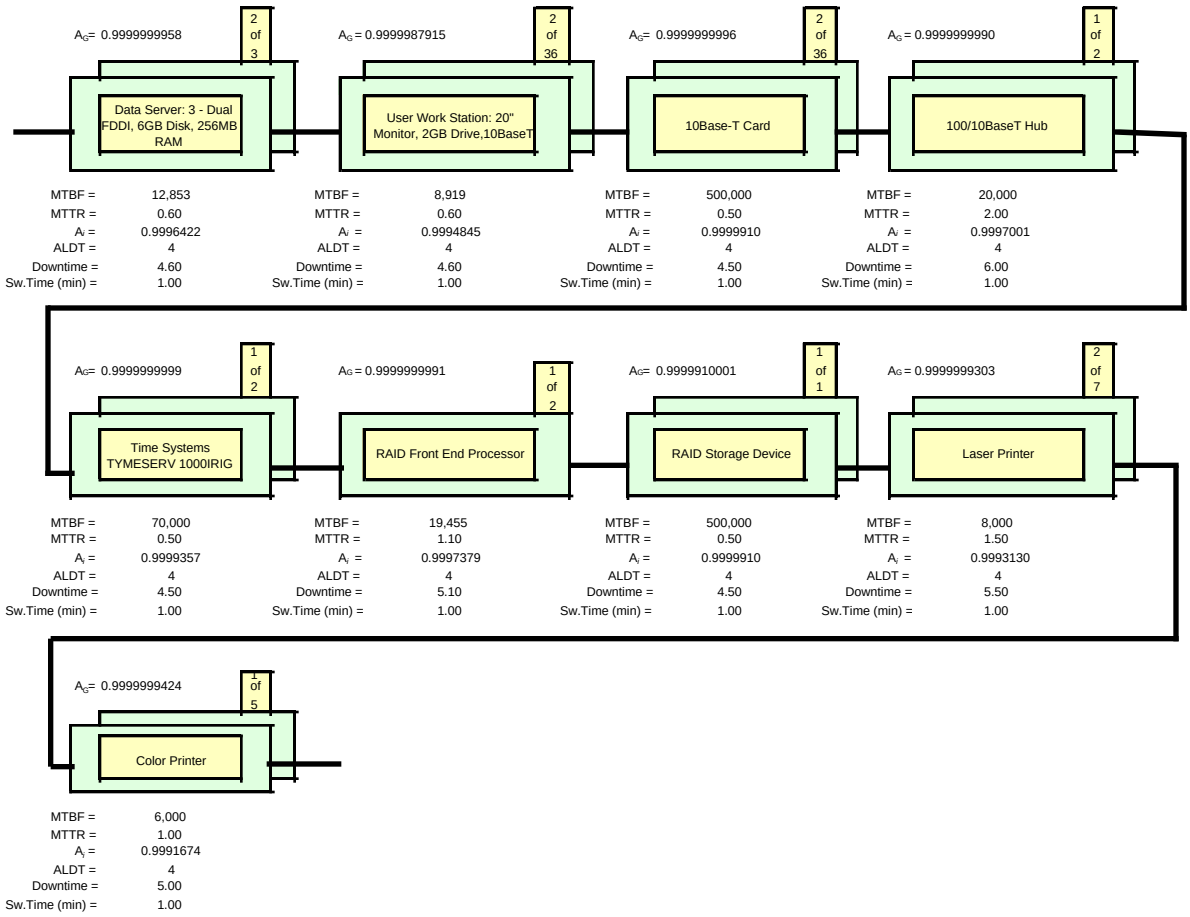

Figure 5.1.2-1. Release A/B FOS Non-Critical Real-Time Functions Hardware Reliability Block Diagram

5.2 CSMS Functions

5.2.1 SMC Function of Gathering and Disseminating System Management Information (EOSD4030)

The Systems Monitoring and Coordination (SMC) Function of Gathering and Disseminating System Management Information provides an enterprise monitoring and coordination capability to all of ECS, respecting DAAC and EOC autonomy. The SMC includes Communication Subsystem (CSS) and Management Subsystem (MSS) servers. The SMC includes the CSS Distributed Communications Hardware Configuration Item (DCHCI) bulletin board server, the CSS-DCHCI enterprise communications server, the MSS-MHCI enterprise monitoring server, and instances of the MSS-MHCI management workstations and printers.

The string analysis supports the integration of the CSS and MSS server to serve as warm standby for each other, cross-strapped to RAID devices for critical data access by either server. All data is replicated throughout ECS, and routinely safe stored in the ECS data server archive. The LSM is designed to continue to function in the event of an EMC failure, and agents at hosts will continue to monitor managed objects in the event of an LSM failure. In the event of a total site CSS failure, critical directory and security access information is replicated throughout the ECS infrastructure, providing multiple access points for communications data. Dual attached FDDI with fault tolerant networks and/or fault tolerant hubs are used within the local DAAC LAN designs for critical RMA links. Throughout ECS, routing tables will be updated to configure around network faults.

Figure 5.2.1-1 shows the reliability block diagram of the SMC Function of Gathering and Disseminating System Management Information with their associated COTS RMA data at the LaRC DAAC. From this diagram, reliability models for the required function were developed to support the availability calculations. Detailed description of these models is provided in Sections 6.0 and 7.0, their results are provided in Appendix A.

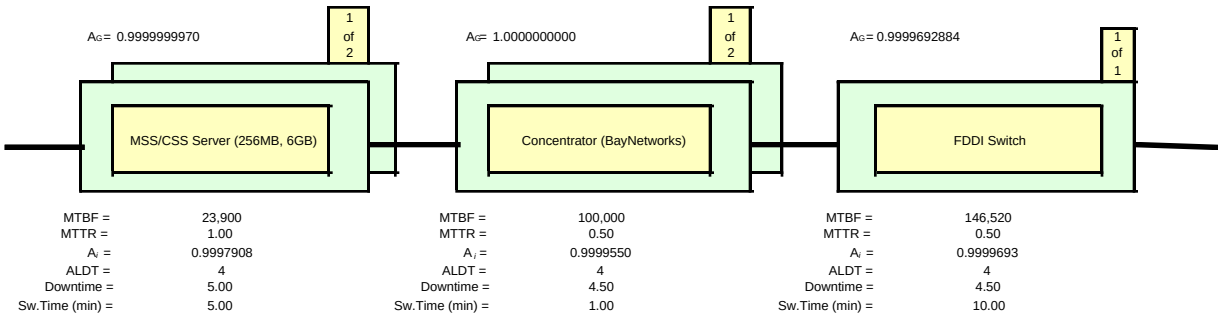

Figure 5.2.1-1. SMC Function of Gathering and Disseminating System Management Information Hardware Reliability Block Diagram

5.3 SDPS Functions

5.3.1 SDPS Function Of Receiving Science Data (EOSD3900)

The Science Data Processing Segment (SDPS) Function Of Receiving Science Data will be performed by the Ingest Subsystem. The Ingest Subsystem contains a collection of hardware and software that supports the ingest of data into ECS repositories on a routine and ad-hoc basis and triggers subsequent archiving and/or processing of the data. The Ingest Subsystem hardware components consist of the client host servers, working storage, and L0 archive repository.

The client host servers manage the transfer of data into, out of, and within the Ingest Subsystem. Additional functions to be performed include logging, status, and reporting activities, coordination of data transfers between working storage and the ingest L0 archive, maintaining a database of all

data contained within the Ingest Subsystem, and servicing queries and retrievals on the archived L0 data. The client hosts will perform pre-processing of the ingested data sufficient both to ensure the basic quality of the received data and to prepare it for archiving and/or further processing.

Short term working storage provides a staging area for data moving both into the Ingest Subsystem from network connections or ingest peripherals, and out of the Ingest Subsystem to the Processing and Data Server Subsystems. This function will be implemented using high performance RAID 5 magnetic disks. Arrays will be shared across ingest client host servers.

The L0 archive repository provides the long term storage portion of the Ingest Subsystem for all ingested spacecraft Level 0 data as received from EDOS for a period of one year. In addition, the long term archive repository, along with short term working storage, passes ingested data to other ECS subsystems as required for processing, and other needs of the data system.

Reference Release A SDPS Ingest Subsystem Design Specification for the ECS Project, 305-CD-009-001, for more details.

Figure 5.3.1-1 shows the reliability block diagram of the SDPS Function Of Receiving Science Data with their associated RMA data at LaRC DAAC. From this diagram, reliability models for the required function were developed to support the availability calculations. Detail description of these models is provided in Sections 6.0 and 7.0, and their results are provided in Appendix A.

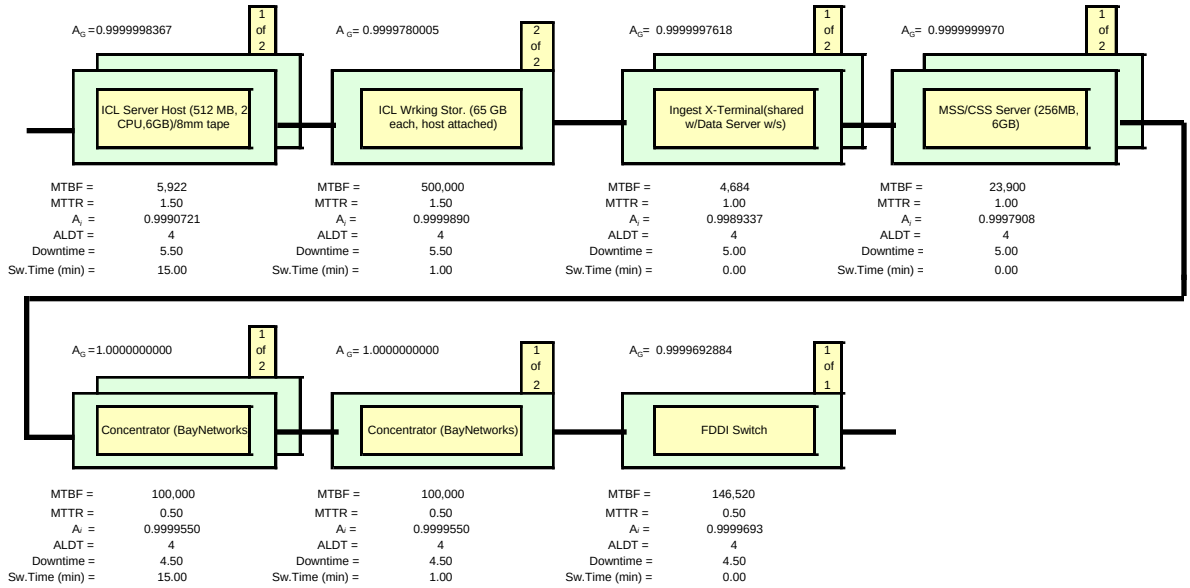

Figure 5.3.1-1 SDPS Function Of Receiving Science Data

5.3.2 SDPS Function of Archiving and Distributing Data (EOSD3920)

The Science Data Processing Segment (SDPS) Function Of Archiving and Distributing Data will be performed by the Data Server Subsystem. This subsystem has the responsibility for storing earth science and related data in a persistent fashion, providing search and retrieval access to this data, and supporting the administration of the data and the supporting hardware devices and software products. As part of its retrieval function, the subsystem also provides for the distribution of data electronically or on physical media.

The Data Server Subsystem hardware consists of:

- Access Control and Management hardware which is responsible for supporting the access to the data server. The Access Control and Management hardware allows for client access (both the client subsystem and direct "push/pull" user access) to the Data Server, provides tools and capabilities for system administration, and supports many of the infrastructure requirements of the Data Server. The Access component is broken down into two components; Administration Stations (AS) and Access/Process Coordinators (APCs). Administration Stations will host and/or allow access to the Administration Services for one or more data servers. The Access/Process Coordinators (APCs) will be used to interface the data server services to the clients. The APCs will support Client session establishment and control.
- Distribution and Ingest Peripheral Management hardware is responsible for hard media distribution methods for data dissemination from the system, as well as hard media ingest of data into the system. The hardware of the Distribution and Ingest Peripheral Management component consists of a variety of recording devices used for both hard media data distribution and hard media data ingest.
- Working Storage HWCI (WKSHW) hardware is responsible for supporting the needs for temporary and buffer storage. The Working Storage (WS) hardware component of the data server supplies a pool of storage used for temporary file and buffer storage within the Data Server architecture.
- Data Repository hardware HWCI (DRPHW) is responsible for permanent data storage and maintenance functions for the Data Server. Data Repositories (DRs) are the hardware components that store and maintain data permanently. For the bulk data holdings that form the lower levels of the data pyramid (i.e., level 1a - level 4), large tape based robotic archives coupled with other robotic based media will be the most cost effective and robust method of permanent data storage. Data that comprises the higher levels of the data pyramid may utilize a different data repository technology for permanent storage, specifically the technology used for operational storage and access. Such technologies can be, as an example, faster access linear tape or, for very fast access, RAID banks.

Reference Release A SDPS Data Server Subsystem Design Specification for the ECS Project, 305-CD-008-001, for more design details.

Figure 5.3.2-1 shows the reliability block diagram of the SDPS Function Of Archiving and Distributing Data with their associated COTS RMA data. From this diagram, reliability models for

the required function were developed to support the availability calculations. Detail description of these models is provided in Sections 6.0 and 7.0, and their results are provided in Appendix A.

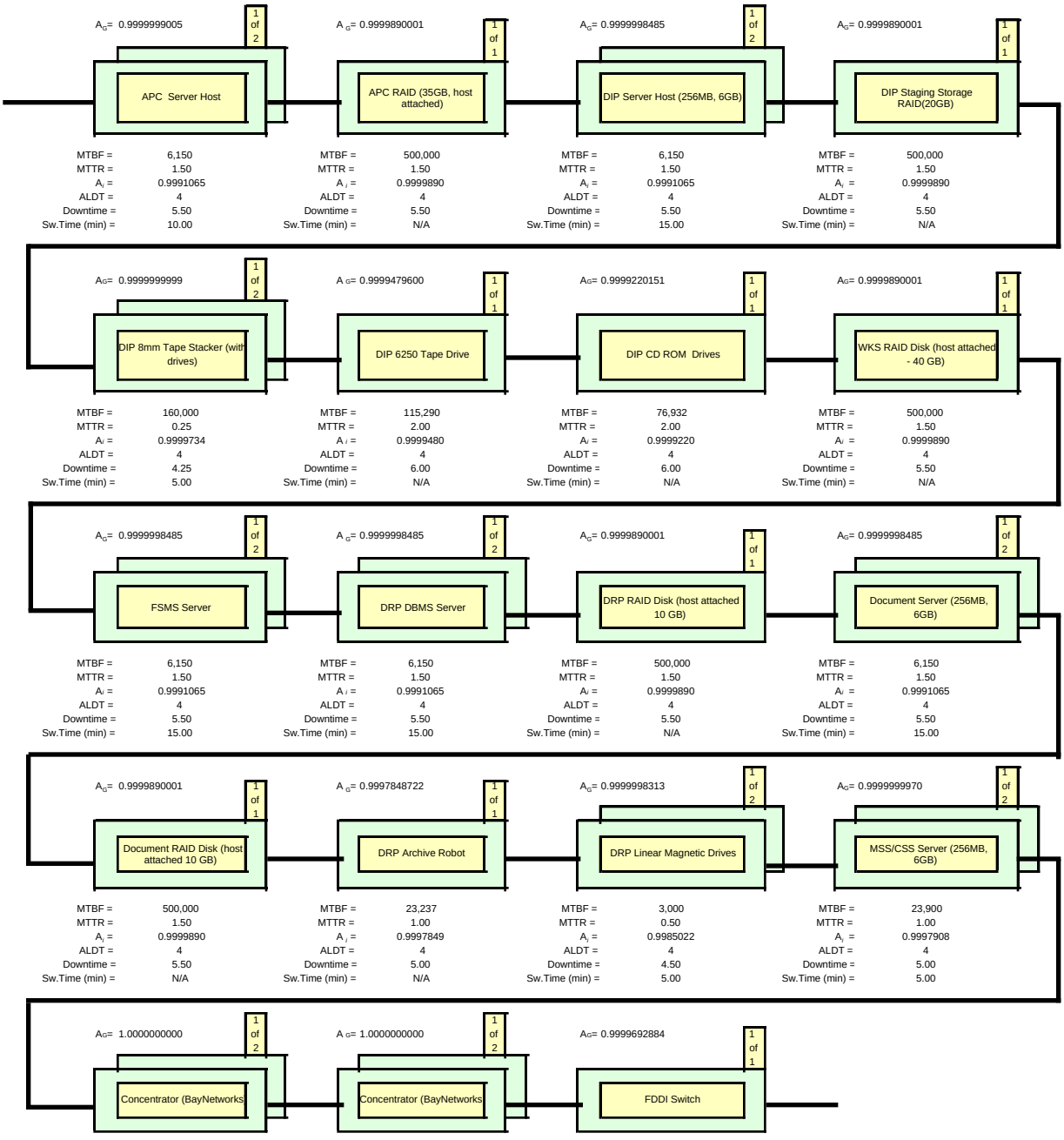

Figure 5.3.2-1 SDPS Function Of Archiving and Distributing Data

5.3.3 SDPS Function of User Interfaces to IMS Services at Individual DAAC Sites (EOSD3930)

The Science Data Processing Segment (SDPS) Function of User Interfaces to IMS Services at Individual DAAC Sites will be performed by the Data Server Subsystem and the Data Management Subsystem. The Data Server Subsystem description can be found in Section 5.3.2. The Data Management subsystem provides services which search for, locate, and access data on behalf of a user or another program.

The Data Management subsystem contains hardware resources for the persistent storage of data dictionary and schema data across one or more DBMS servers, supports processing, DBMS management, data specialists and user support functions. The primary technologies employed within this subsystem include DBMS servers, World Wide Web servers, host attached disk, possible use of RAID disk and a variety of communications capabilities. Pools of local workstations will support DBMS management, data repository administration, data specialist, user support and phone/mail support functions. The hardware associated with the DMGHW CI consists of servers, low-end uni-processor workstations, RAID disk, and 8mm tape drives used in support of Release A Advertising Service CI and Gateway CI database configurations. The number of physical components, and whether or not certain components will be used, is dependent on each DAAC specific configuration.

Reference Release A SDPS Data Management Subsystem Design Specification for the ECS Project, 305-CD-007-001, for more design details.

Figure 5.3.3-1 shows the reliability block diagram of the SDPS Function Of User Interfaces to IMS Services at Individual DAAC Sites with their associated COTS RMA data. From this diagram, reliability models for the required function were developed to support the availability calculations. Detail description of these models is provided in Sections 6.0 and 7.0, and their results are provided in Appendix A.

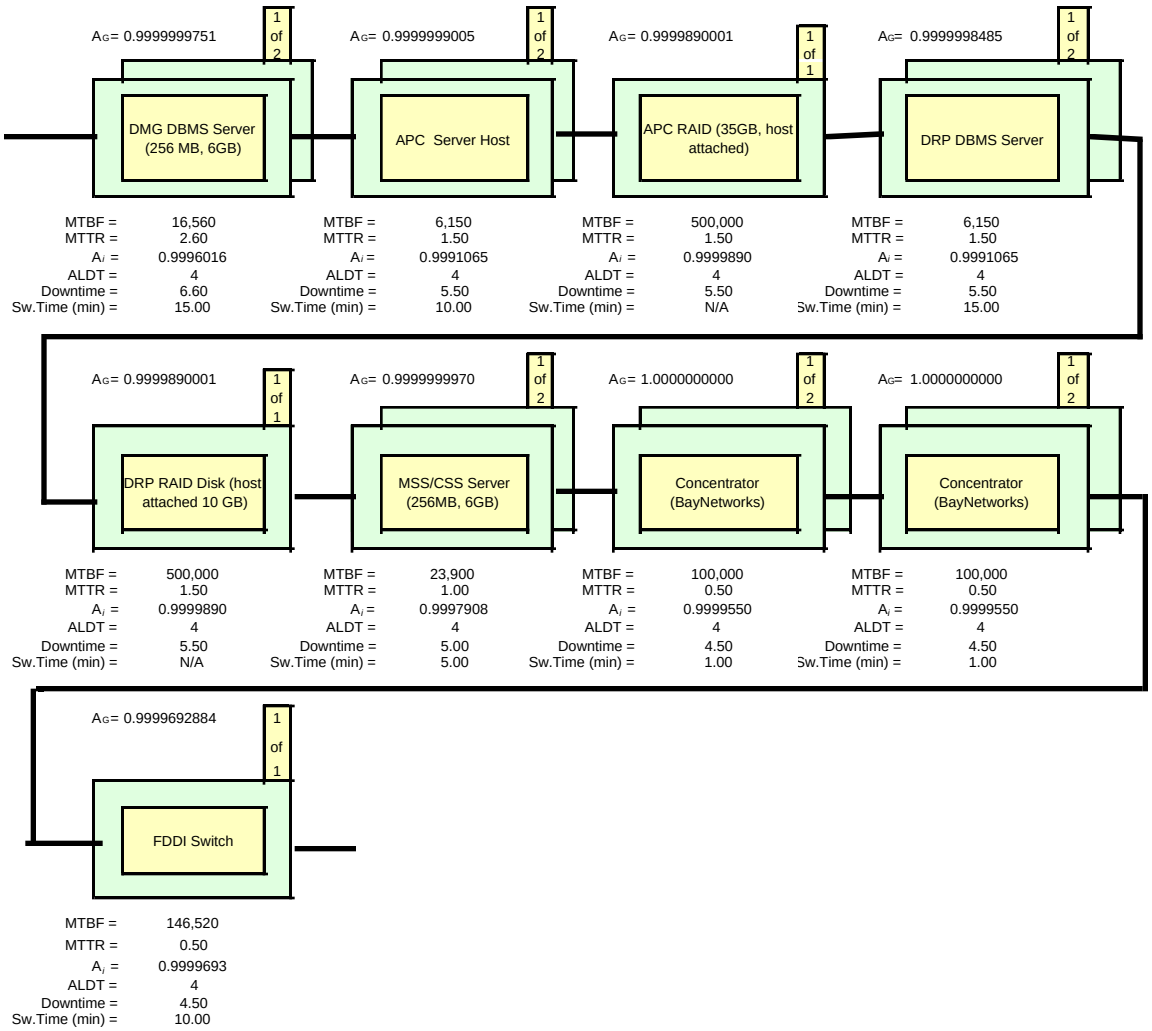

Figure 5.3.3-1. SDPS Function Of User Interfaces to IMS Services at Individual DAAC Sites

5.3.4 SDPS Function of Information Searches on the ECS Directory (EOSD3940)

The Science Data Processing Segment (SDPS) Function of Information Searches on the ECS Directory will be performed by the Data Server Subsystem and the Data Management Subsystem. The Data Server Subsystem description can be found in Section 5.3.2. The Data Management Subsystem description can be found in the previous Section 5.3.3.

Figure 5.3.4-1 shows the reliability block diagram of the SDPS Function Of Information Searches on the ECS Directory with their associated COTS RMA data. From this diagram, reliability models for the required function were developed to support the availability calculations. Detail description of these models is provided in Sections 6.0 and 7.0, and their results are provided in Appendix A.

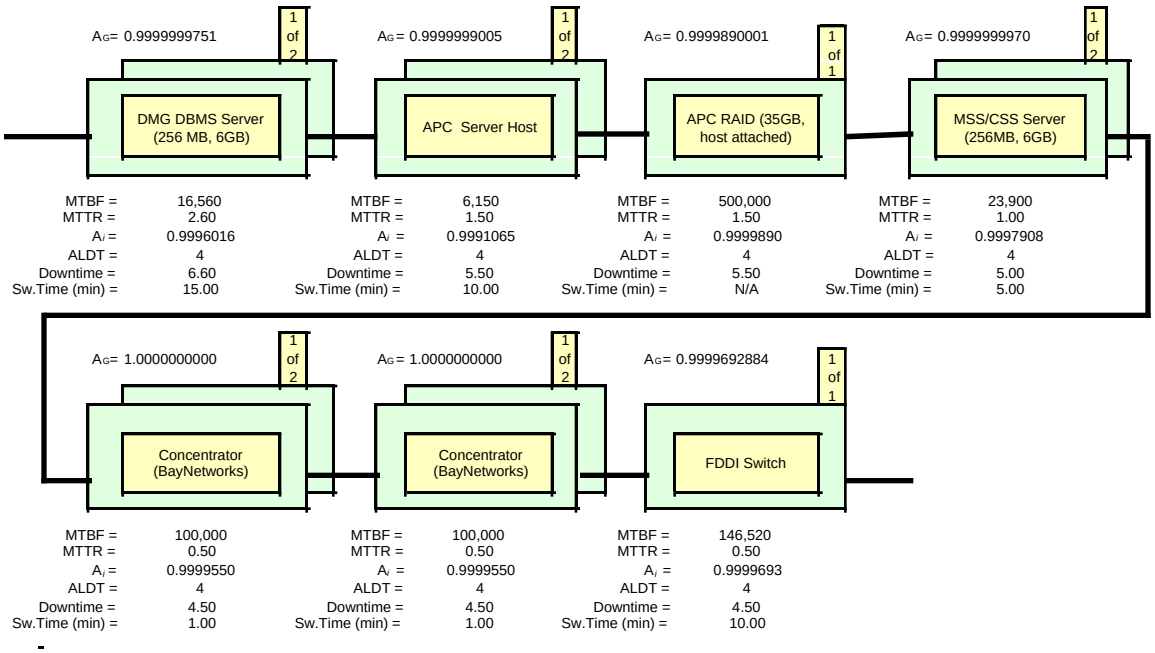

Figure 5.3.4-1. SDPS Function Of Information Searches on the ECS Directory

5.3.5 SDPS Function of Metadata Ingest and Update (EOSD3960)

The Science Data Processing Segment (SDPS) Function Of Metadata Ingest and Update will be performed by the Data Management, Ingest, and Data Server subsystems. The Data Management subsystem description can be found in the previous Section 5.3.3. The Ingest subsystem description can be found in the previous Section 5.3.1. The Data Server Subsystem description can be found in Section 5.3.2.

Figure 5.3.5-1 shows the reliability block diagram of the SDPS Function Of Metadata Ingest And Update with their associated COTS RMA data. From this diagram, reliability models for the required function were developed to support the availability calculations. Detail description of these models is provided in Sections 6.0 and 7.0, and their results are provided in Appendix A.

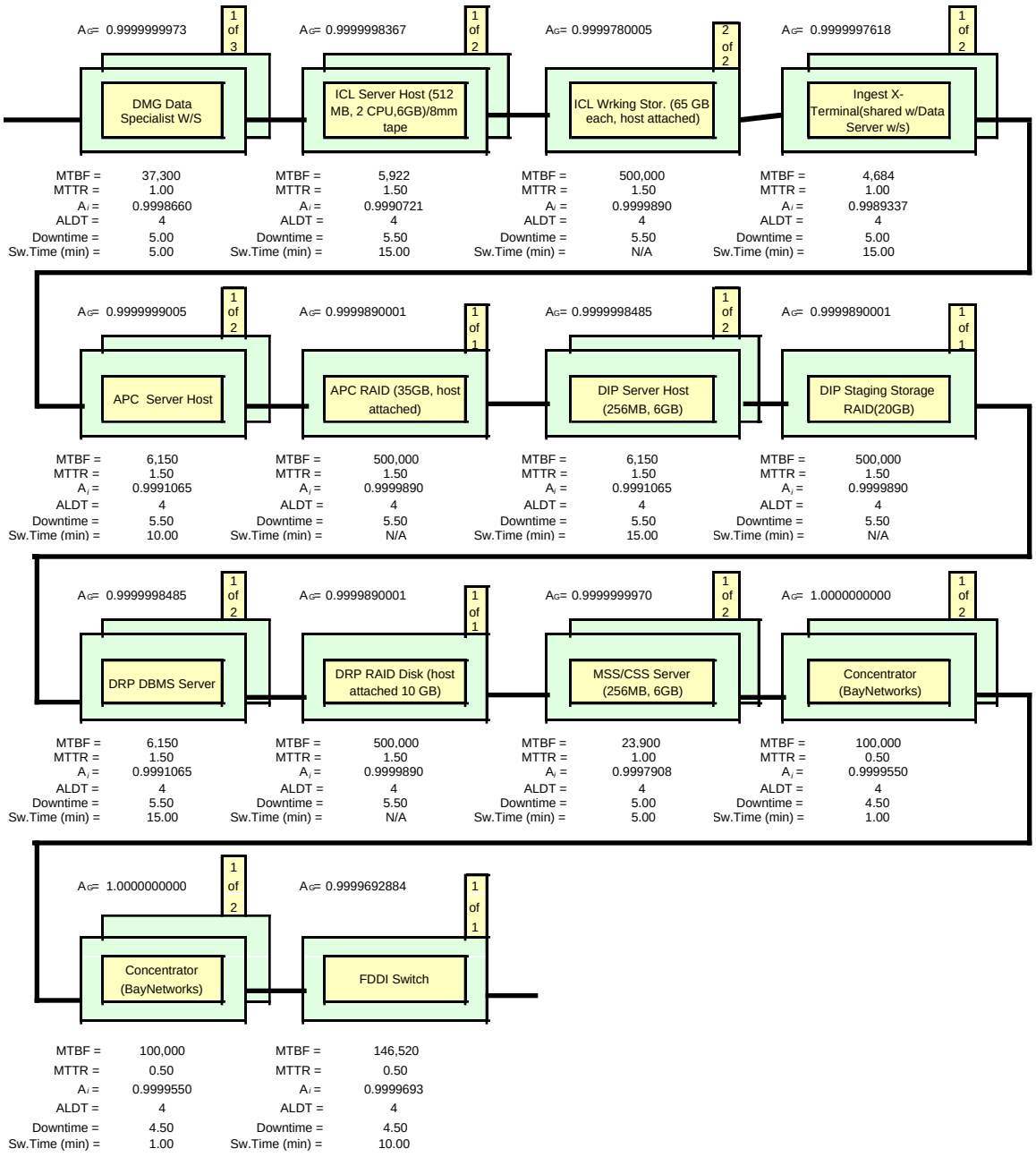

Figure 5.3.5-1. SDPS Function Of Metadata Ingest And Update

5.3.6 SDPS Function of Information Searches on Local Holdings (EOSD3970)

The Science Data Processing Segment (SDPS) Function of Information Searches on Local Holdings will be performed by the Data Server Subsystem. The Data Server Subsystem description can be found in Section 5.3.2.

Figure 5.3.6-1 shows the reliability block diagram of the SDPS Function Of Information Searches On Local Holdings with their associated COTS RMA data. From this diagram, reliability models for the required function were developed to support the availability calculations. Detail description of these models is provided in Sections 6.0 and 7.0, and their results are provided in Appendix A.

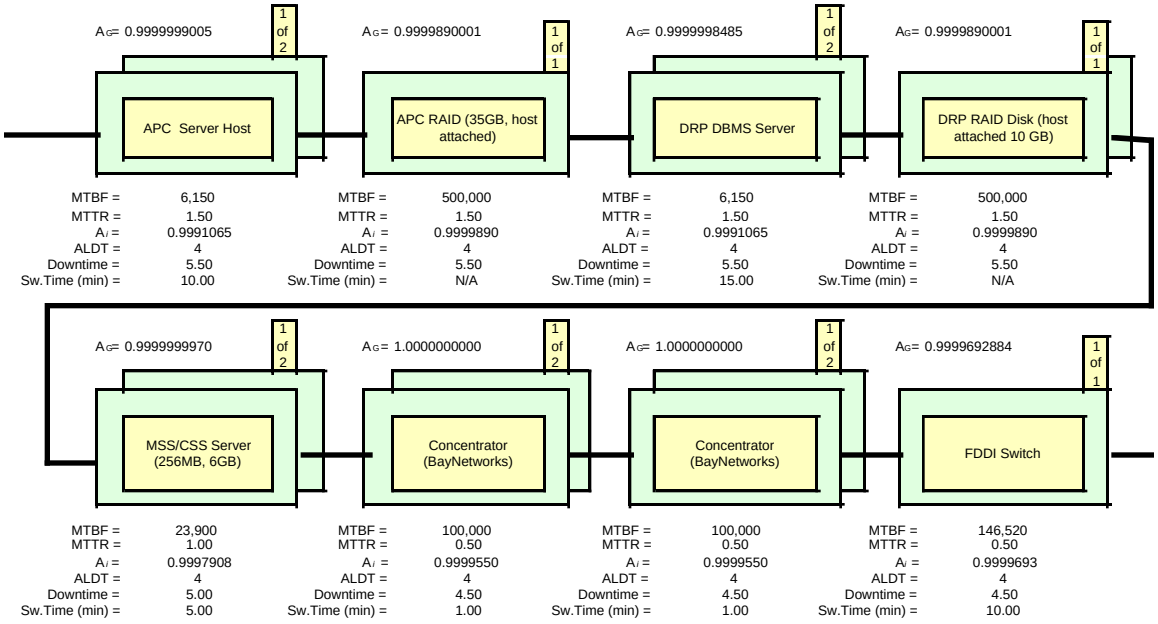

Figure 5.3.6-1. SDPS Function Of Information Searches On Local Holdings

5.3.7 SDPS Function of Local Data Order Submission (EOSD3980)

The Science Data Processing Segment (SDPS) Function of Local Data Order Submission is performed by the Data Management and Data Server subsystems. The Data Management subsystem description can be found in Section 5.3.3. The Data Server Subsystem description can be found in Section 5.3.2.

Figure 5.3.7-1 shows the reliability block diagram of the SDPS Function Of Local Data Order Submission with their associated COTS RMA data. From this diagram, reliability models for the required function were developed to support the availability calculations. Detail description of these models is provided in Sections 6.0 and 7.0, and their results are provided in in Appendix A.

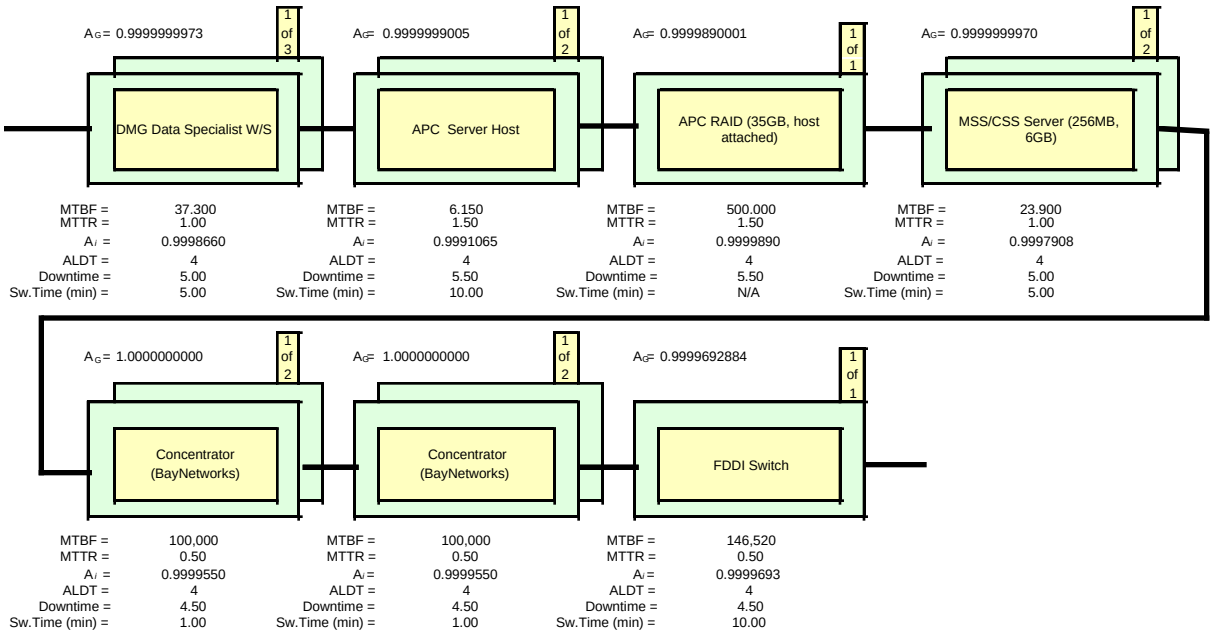

Figure 5.3.7-1 . SDPS Function Of Local Data Order Submission

5.3.8 SDPS Function of Data Order Submission Across DAACs (EOSD3990)

The Science Data Processing Segment (SDPS) Function of Data Order Submission Across DAACs will be performed by the Data Management, and Data Server subsystems. The Data Management subsystem description can be found in Section 5.3.3. The Data Server Subsystem description can be found in Section 5.3.2.

Figure 5.3.8-1 shows the reliability block diagram of the SDPS Function Of Data Order Submission Across DAACs with their associated COTS RMA data. From this diagram, reliability models for the required function were developed to support the availability calculations. Detail description of these models is provided in Sections 6.0 and 7.0, and their results are provided in in Appendix A.

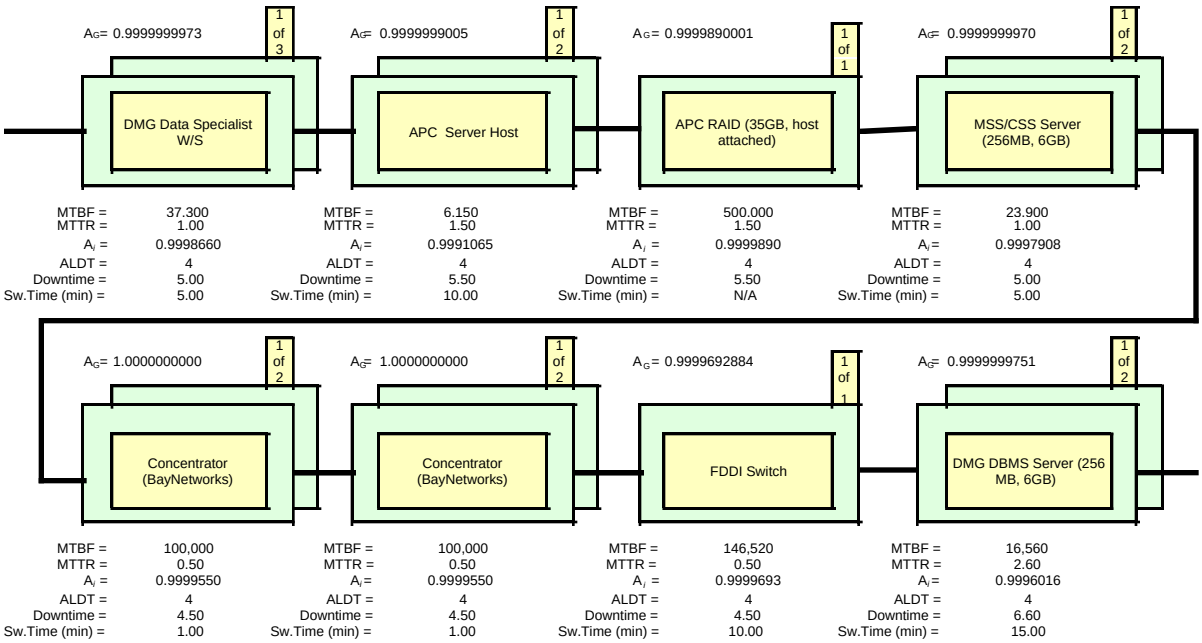

Figure 5.3.8-1. SDPS Function Of Data Order Submission Across DAACs

5.3.9 SDPS Function of IMS Data Management and Maintenance Interface (EOSD4000)

The Science Data Processing Segment (SDPS) Function of IMS Data Management and Maintenance Interface will be performed by the Data Management, and Data Server subsystems. The Data Management subsystem description can be found in Section 5.3.3. The Data Server Subsystem description can be found in Section 5.3.2.

Figure 5.3.9-1 shows the reliability block diagram of the SDPS Function Of IMS Data Base Management and Maintenance Interface with their associated COTS RMA data. From this diagram, reliability models for the required function were developed to support the availability calculations. Detail description of these models is provided in Sections 6.0 and 7.0, and their results are provided in Appendix A.

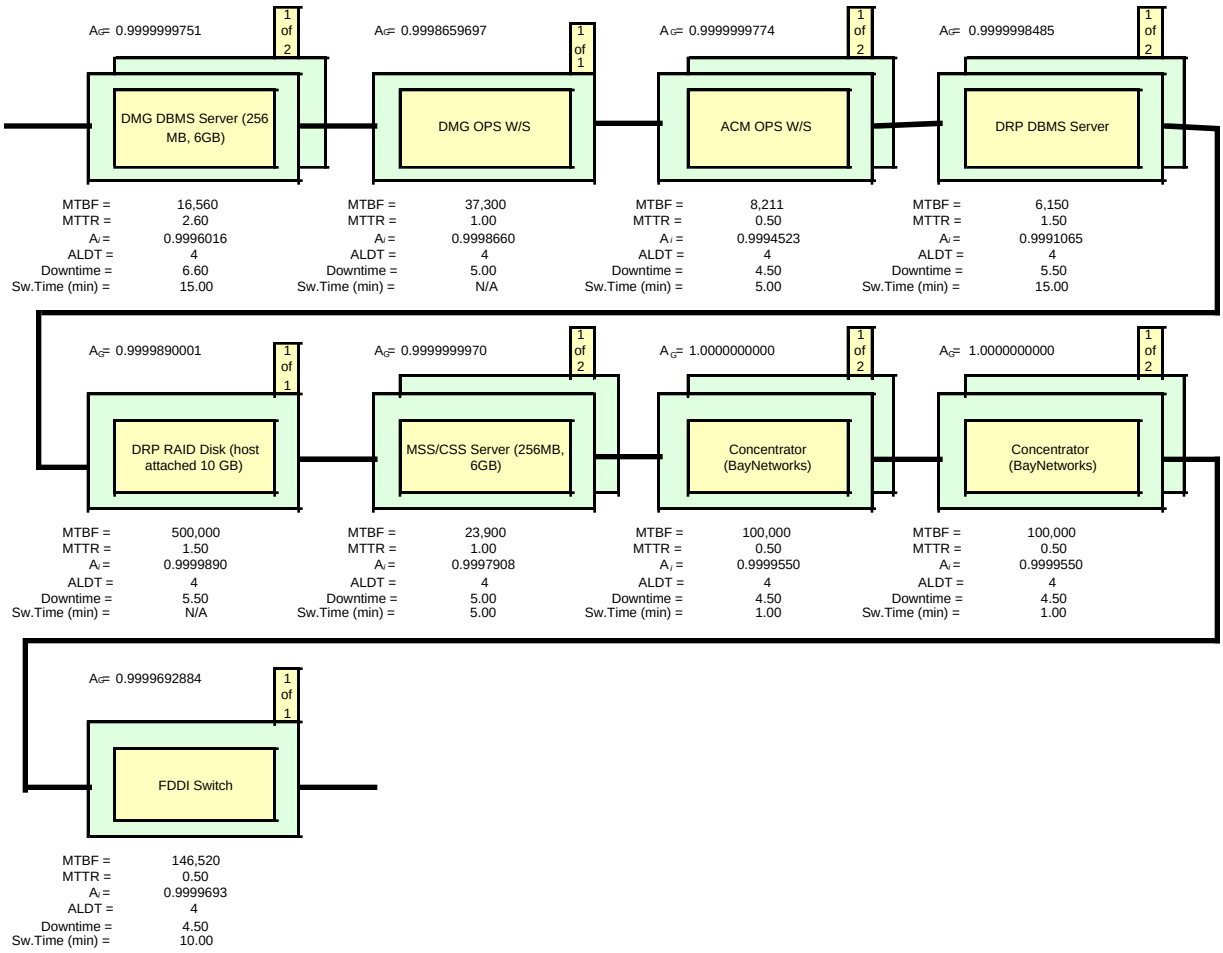

Figure 5.3.9-1. SDPS Function Of IMS Data Base Management and Maintenance Interface

5.3.10 Computer Providing Product Generation (EOSD4010)

The product generation computer, which is part of the Data Processing Subsystem, provides a batch processing environment to support the generation of data products. It manages, queues and executes Data Processing Requests on the processing resources at a provider site. A Data Processing Request can be defined as 1 processing job. Each Data Processing Request encapsulates all of the information needed to execute this processing job. Data Processing Requests are submitted from the Planning Subsystem; which in turn have been triggered by arrival of data or a user request (i.e. Data Server) or internally through Planning itself (e.g. reprocessing).

The product generation computer can be one of the following.

SMP-L is a shared memory processor initially configured as a single processor machine but is scalable (can easily be upgraded with multi-processors).

SMP-H is a shared memory processor which can either be logically shared and physically distributed (up to 64 processors) or be logically shared and physically shared (such as a vector processor). A "minimum" configuration is 2 processors.

A SMP Cluster is a grouping of SMPs that provides increased scalability.

The product generation computer availability (Ao) requirement is 0.95 and is calculated as follows:

$$A_o = \frac{MTBM}{MTBM + MDT}$$

The MTBM and MTTR are obtained from the COTS vendor. The MDT is equal to the MTTR plus 4 hours of estimated logistics delay time. Therefore:

$$A_{o(\text{computer generation})} = \frac{6,075}{6,075 + (1+4)} = .999178$$

5.3.11 SDPS Function of Planning and Data Processing

The Science Data Processing Segment (SDPS) Function of Planning and Data Processing is defined in order to assure that all major SDPS hardware components are analyzed.

The Planning and Data Processing function is derived from the EOSD3700 System-Level Availability Requirement which states that all equipment providing other functionality not explicitly stated in the Segment-level availability requirements will be subject to an operational availability of 0.96 at a minimum and an MDT of four (4) hours or less.

The Science Data Processing Segment (SDPS) Function of Planning and Data Processing is performed by the Data Processing Subsystem (DPS) and the Planning Subsystem. The DPS is responsible for managing, queuing, and executing processes at each DAAC site and consists of Science Processing hardware (SPRHW) and Algorithm Integration and Testing hardware (AITHW). The Planning subsystem is responsible for supporting the operations staff in managing the data production activities at a DAAC site and for coordinating this production with the Data Server Subsystem and Data Processing Subsystem. The Planning hardware (PLNHW) consists of a Production Planning/Management workstation and a Planning DBMS server.

The Science Processing HWCI (SPRHW) is the primary HWCI in the Processing Subsystem and contains staging (working storage), input/output (I/O), and processing resources necessary to perform routine processing, subsequent reprocessing, and Algorithm Integration & Test (AI&T) processing. The SPRHW consists of science processors and queuing server. The science processors (one for standard production processing and one for AI&T processing) provide site specific processing for science software integration and testing, standard production, and

reprocessing and consist of SMP (Symetric Multi-Processor) Science Processors and host attached RAID. The AI&T science processor will back-up the standard production processor in the event of a failure. The queuing server provides support for production queuing, monitoring and control. The planning DBMS server in the PLNHW will back-up the queuing server in the event of a failure.

The Algorithm, Integration, and Test hardware (AITHW) consists of a workstation and workstation/server and supports the integration and testing of science algorithms running on the AI&T processor.

The Production Planning/Management workstation supports routine production planning and task queuing production management operations. The Planning DBMS server maintains the status and planning database repositories of the Data Processing Subsystem. The queuing server in the SPRHW will back-up the the planning DBMS server in the event of a failure.

Reference Release A SDPS Data Processing Subsystem Design Specification for the ECS Project, 305-CD-011-001, and Release A SDPS Planning Subsystem Design Specification for the ECS Project, 305-CD-010-001, for more design details.

Figure 5.3.11-1 shows the reliability block diagram of the SDPS Function of Planning and Data Processing with their associated hardware and generic COTS RMA data. From this diagram, reliability models for the derived function were developed to support the availability calculations. A detailed description of these models is provided in Section Sections 6.0 and 7.0, and their results are provided in Appendix A.

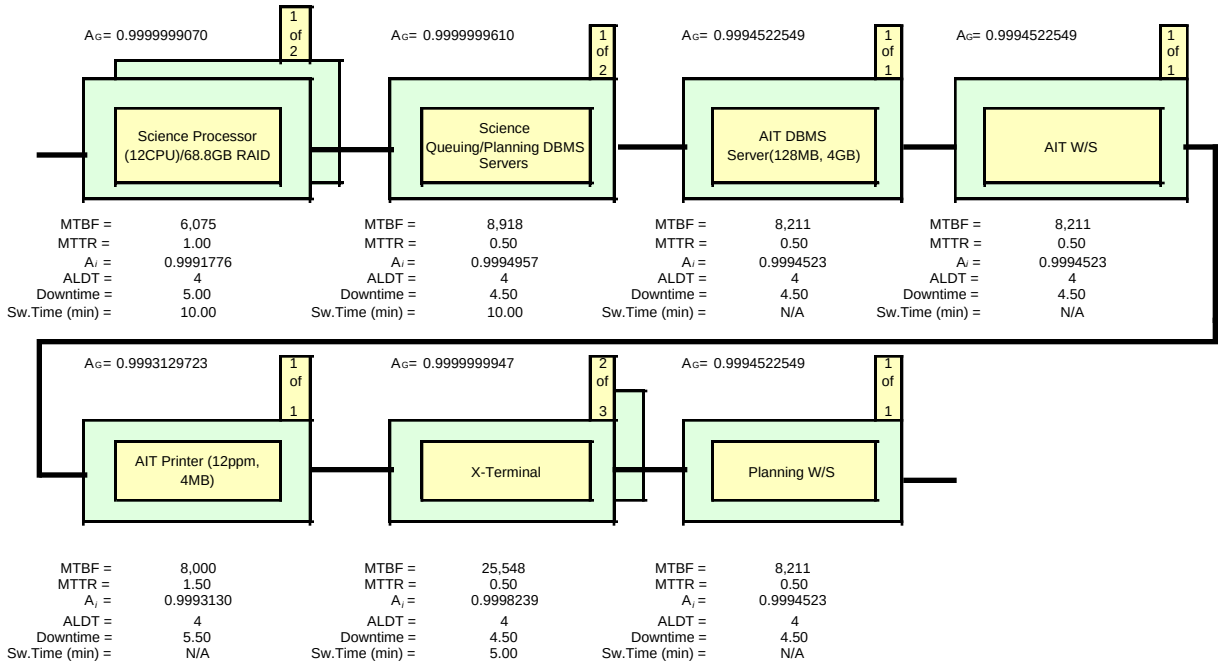

Figure 5.3.11-1. SDPS Function Of Planning and Data Processing

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6. ECS Availability Math Models

6.1 Availability Math Models

The following sections present the math models that support the availability calculations for all required ECS RMA functions.

6.1.1 Operational Availability (A_O).

The operational availability is defined as follows:

$$Ao = \frac{MTBM}{MTBM + MDT}$$

where: MTBM is the Mean Time Between Maintenance in hours and

MDT is the Mean Down Time in hours

For systems with backup redundant capability, the operational availability is defined as follows:

$$Ao = \frac{MTBM}{MTBM + ST}$$

where: ST is the Switchover time to a backup component in hours

6.1.2 Mean Time Between Maintenance (MTBM)

The MTBM consists of two components: the Mean Time Between Preventive Maintenance (MTBPM) and the Mean Time Between Corrective Maintenance (MTBCM). These two components of the ECS equipment each will contribute to the calculation of the MTBM and follow the relationship:

$$\frac{1}{MTBM} = \frac{1}{MTBPM} + \frac{1}{MTBCM}$$

Normally when equipment is required to have a scheduled maintenance, the COTS vendor will provide to the ECS contractor the time interval for this task. This time interval is the MTBPM.

The MTBCM is the same as Mean Time Between Failures (MTBF) which is the inherent reliability of the equipment. MTBF can be obtained from the COTS vendors, reliability predictions or Non-Electronic Parts Reliability Data (NPRD) handbook.

6.1.3 Mean Down Time (MDT)

The MDT includes the Mean Time To Repair (MTTR) plus any Administrative Logistics Delay Times (ALDT):

$$MDT = MTTR + ALDT$$

- MTTR is defined by the following equation: $$MTTR = \frac{\sum_{i=1}^{i=n} \lambda i Mcti}{\sum_{i=1}^{i=n} \lambda i}$$

  where: - λi is the failure rate of the ith component in Failures Per Million Hours (FPMH) or $\frac{1}{MTBFi} \times 10^6$.

  - Mcti is the Mean Corrective Time of the ith component which is the sum of maintenance task times such as: localization, isolation, disassembly, interchange, reassembly, alignment, and checkout times. These times can be obtained from COTS vendors or Maintainability predictions report, document 518-CD-001-003.

- ALDT is defined as delay time which prevent the system from returning to an available state, including travel time, administrative delays, and logistics delays. ALDT is equipment and site specific and is defined by the ECS COTS Maintenance Plan, document 613-CD-001-001. For calculation purpose the ALDT is assumed to be four (4) hours for all ECS of hardware configuration items (HWCIs).

6.1.4 Switchover Time (ST)

The switchover time (ST) is the time required by the system to restore its functions by switching from the downed equipment to the backup equipment. The backup equipment can be redundant active on-line (hot backup) or inactive off-line (warm standby). Switchover times are best engineering estimates and were based on ECS fault management and recovery capabilities or COTS equipment fault diagnostics capabilities.

6.2 Systems Availability Math Models

The following sections present the mathematical models at the system or functional level.

6.2.1 Serial Systems

For systems with n components in series, the following equations are applied:

$$\text{System Availabilty } (A_s) = \prod_{i=1}^{n} Ai$$

$$\text{System MTBM:} \quad MTBM_s = \frac{1}{\sum_{i=1}^{n} \frac{1}{MTBM_i}}$$

$$\text{System MDT:} \quad MDT_s = \frac{\sum_{i=1}^{n} MDT_i \times \lambda_i}{\sum_{i=1}^{n} \lambda_i}$$

where: A_i, $MTBM_i$, and MDT_i are the availability, MTBM and MDT of the ith component respectively.

6.2.2 Parallel Systems with r out of n components required

For parallel or redundant systems with r out of n components required, where r is the number of components or equipment required for mission success and n is the total number of available components, then the equations in the next sections are applied with the following assumptions:

- Once the primary equipment fails, the secondary or redundant equipment will be switched on-line
- The downed or failed equipment will in turn be replaced with a spare unit or will be repaired within its MDT
- All units are functional at the start
- Maintenance personnel is always available at the site
- One equipment can only be repaired at a time.

6.2.2.1 System with Active On-Line Redundancies (Hot Backup)

For redundant systems with active on-line or "hot backup" component, the following operational availability (A_O) equation is used:

$$\text{Availability } (A_o) = \frac{MTBF_R}{MTBF_R + MTTR_R}$$

$$MTBF_R = MTBF_i \times \left(\frac{MTBF_i}{MTTR_i}\right)^{n-r} \times \frac{(n-r)!(r-1)!}{n!}$$

$$MTTR_R = \frac{MTTR_i}{n - r + 1}$$

where:

- $MTBF_R$ and $MTTR_R$ are the effective MTBF and MTTR of the redundant group, respectively.

- $MTBF_i$ and $MTTR_i$ are the MTBF and MTTR of the ith component, respectively.

6.2.2.2 System with Inactive Off-Line Redundancies (Warm Standby)

For redundant systems with inactive off-line spares, the following equation is applied assuming that the standby unit failure rate is the same as the on-line unit failure rate.

$$MTBF_R = \frac{\mu + n(P+1)\lambda}{n[n\lambda + (1-P)\mu\lambda]}$$

where: - μ is the repair rate: $\mu = \frac{1}{MDT + SwitchOverTime}$

-P is the probability switching mechanism that will operate properly when needed and it is equal to 1.0 (perfect switching by maintenance personnel).

6.2.2. Duty Cycle Calculation

In some cases, at the DAAC sites certain equipment such as peripheral devices (i.e archive robot arm, 6250 tape drive, 8mm tape stacker, etc.) are not constantly operated, their inherent failure rate is therefore duty cycled by their ulization estimates and follows the equation below:

$$\text{Effective Failure Rate (F / R)} = \left[\text{Inherent F / R} \times \text{Duty Cycle}\right] + \left[\text{Inherent F / R} \times (1 - \text{d.c.}) \times 10\%\right]$$

10% is the rule of thumb estimate for stand-by failure rate by Rome Air Development Center (RADC).

7. ECS RMA Modeling Process

7.1 Model Implementation Overview

The ECS availability models have been implemented using Excel 5.0 workbooks. The models consist of a series of linked workbooks and workbook pages (worksheets) that accept user's inputs, calculate individual equipment availability as well as functional HWCI group availability, and display the results in tabulated and graphical formats using equations described in Section 6. This process also allows the user to exercise "what-if" scenarios so that the reliability analysis results can be timely fed back to the designers and logistics personnel for the performance of trade studies.

7.1.1 Modeling Description

For the FOS Release A/B and SDPS/CSMS Release A CDRs there are a total of five (5) workbooks that are being used to support the ECS availability modeling task. These are the FOS, LaRC, MSFC, GSFC and EDC CDR workbooks. Each workbook contains approximately thirty (30) worksheets consisting of the results summary table, site input tables, subsystem tables, functional requirement tables, and block diagrams.

The site input table is the heart of the ECS availability model. This table is the main database that contains all pertinent RMA information such as the equipment's description, part number, MTBF, MTTR, ALDT, MDT, Switchover Time, Total Number Of Units in the system, Number of Required Units for functional success, redundancy configuration and the switchover probability. From the Inputs table, each Subsystem table and functional requirements table was formed by extracting the subsystem's and function's associated HWCIs, respectively. Then from these tables the block diagrams were generated. Figure 7.1.1-1 shows the general ECS Availability Models database structure and the worksheets relationship. The worksheets are linked within the workbook and the workbooks are also linked to the Results Summary Table in the RA_LaRC workbook.

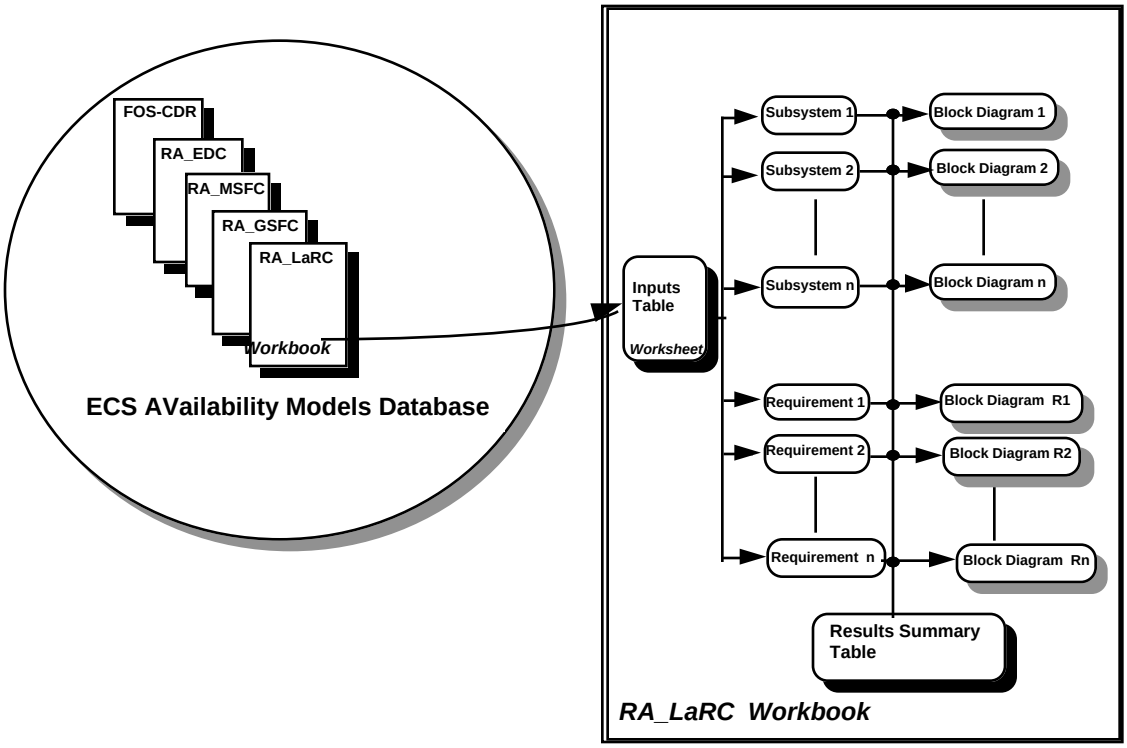

Figure 7.1.1-1. ECS Availability Model Database Structure

7.1.2 Input Table Description

The Input Table worksheets provides a mechanism for user's inputs, computes the availability of each equipment, subsystem and function and forwards the input and results to the other worksheets for display or archival. These input worksheets will accept user's inputs such as: the equipment's part number, MTBF, MTTR, ALDT, switchover time, number of units available, number of units that are allowed to fail, type of subsystem redundancy, and the probability of switching when a given unit fails. The functional availability and MDT results are displayed at the bottom of the corresponding worksheet. Figure 7.1.2-1 shows a sample of the Input Table worksheet at the LaRC site. Appendix A provides a detailed description of the worksheet headings.

EOSD3900: Function of Receiving Science Data

Rel	Site	Subsys Descrip	Equipment Description	Model/Part Number	MTBF (hour)	MTTR (hour)	Admin Logis Delay Time (hour)	Switch-over Time (min)	Total Down-time (hour)	# of Units Rqrd (m)	Total # Of Units (n)	Redundancy	Unit Availability (Ai)	P	Redundant Group Availability (m out of n)
A	LaRC	Ingest	ICL Server Host (512 MB, 2 CPU,6GB)/8mm tape	SGI Challenge L/Exabyte	5,922	1.50	4	15.00	5.50	1	2	standby off-line	0.9990721	1.0	0.9999998
A	LaRC	Ingest	ICL Wrking Stor. (65 GB each, host attached)	SGI RAID 5	500,000	1.50	4	N/A	5.50	2	2	N/A	0.9999890	N/A	0.9999780
A	LaRC	Ingest	Ingest X-Terminal(shared w/Data Server w/s)	NCD Xterm	4,684	1.00	4	15.00	5.00	1	2	standby off-line	0.9989337	1.0	0.9999998
A	LaRC	LSM	MSS/CSS Server (256MB, 6GB)	HP755/125	23,900	1.00	4	5.00	5.00	1	2	standby off-line	0.9997908	1.0	1.0000000
A	LaRC	ISS	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	LaRC	ISS	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	LaRC	ISS	FDDI Switch	Atlantec Power Hub 7000	146,520	0.50	4	10.00	4.50	1	1	N/A	0.9999693	N/A	0.9999693
				EOSD3900: Ao =	0.999946885										
				MDT =	0.246227726										

Figure 7.1.2-1. Sample of Input Table Worksheet at LaRC Site

7.1.3 Reliability Block Diagram Description

The availability models for the required ECS functions are graphically presented as block diagrams in Appendix A in conjunction with the functional worksheets.

The availability (A_G) value, shown on the top of each equipment's block, is the group availability for the redundant units. For a single unit, A_G is equal to Ai which is the unit availability. The redundant configuration is shown in the upper right corner box. The MTBF, MTTR, Ai, ALDT, Downtime, and Switchover time values for each equipment, and redundant group, are displayed below each corresponding equipment and redundant group as shown in Figure 7.1.3-1.

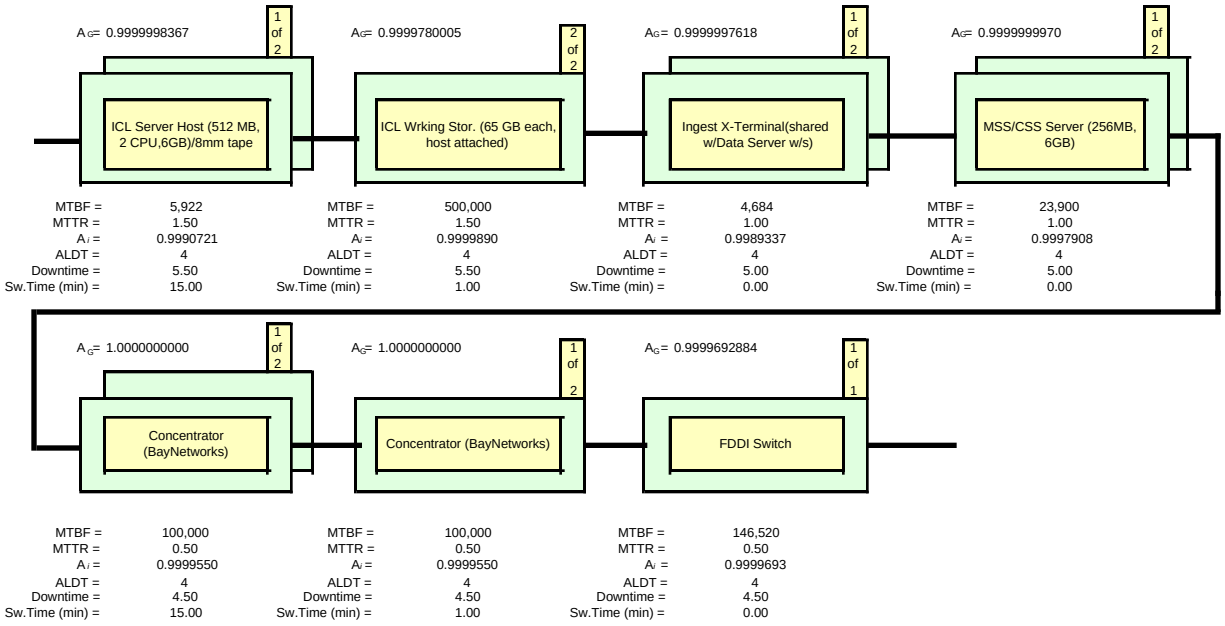

Figure 7.1.3-1. Sample of a Reliability Block Diagram at LaRC Site

8. Summary Of ECS Availability Results

The following table summarizes the availability (A_O) and MDT results for all ECS required functional availabilities at LaRC, MSFC and GSFC DAAC sites. These results were obtained from the analytical availability models presented in Appendix A which reflect the SDPS/CSMS Release A and FOS Release A/B physical architecture at the CDR time frame.

For Release A, the EDC DAAC will be used solely for algorithm, integration and test purpose. This is not an operational site. Therefore, the EDC's availability was not computed.

For Release A, there will be no real-time L0 Science Data Ingested at the GSFC DAAC site. Therefore, the function of Receiving Science Data (EOSD3900) does not apply for the GSFC DAAC.

As shown from the tables below, all quantitative RMA requirements for the ECS and its Segments, at the Release A, FOS Release A/B, Critical Design Review (CDR) time frame, have achieved their required values with considerable margin. Since the requirements are applied to the final release configuration, the margin is necessary to allow the system to grow, evolve, and still meet the requirements. These availability and MDT computations will be continuously evaluated and updated throughout the program's life cycle as the system design evolves.

Table 8-1. A_O/MDT Required vs Predicted Values at LaRC, MSFC and GSFC

Req't Nos. (Ao/MDT)	LaRC		MSFC		GSFC	
	Ao	MDT(hrs)	Ao	MDT(hrs)	Ao	MDT(hrs)
EOSD3700 (0.96/<4.0 hrs)	0.9976716	2.95	0.9967215	3.75	0.9959019	3.74
EOSD3800 (0.99980/<1.0 Min)	N/A	N/A	N/A	N/A	0.9999897	0.02
EOSD3810 (0.99925/<5.0 Min)	N/A	N/A	N/A	N/A	0.9999898	0.02
EOSD3900 (0.999/2.0 hrs)	0.9999469	0.25	0.9999469	0.25	N/A	N/A
EOSD3920 (0.98/<2.0 hrs)	0.9995683	0.48	0.9995418	0.50	0.9995418	0.50
EOSD3930 (0.993/<2.0 hrs)	0.9999470	0.24	0.9999470	0.24	0.9999470	0.24
EOSD3940 (0.993/<2.0 hrs)	0.9999582	0.20	0.9999582	0.20	0.9999582	0.20
EOSD3960 (0.96/<4.0 hrs)	0.9999135	0.26	0.9999135	0.26	0.9999135	0.26
EOSD3970 (0.96/<4.0 hrs)	0.9999470	0.24	0.9999470	0.24	0.9999470	0.24
EOSD3980 (0.96/<4.0 hrs)	0.9999582	0.17	0.9999582	0.17	0.9999582	0.17
EOSD3990 (0.96/<4.0 hrs)	0.9999582	0.19	0.9999582	0.19	0.9999582	0.19
EOSD4000 (0.96/<4.0 hrs)	0.9998241	0.49	0.9998241	0.49	0.9998241	0.49
EOSD4010 (Ao < 0.95)	0.9991776	N/A	0.9991776	N/A	0.9991776	N/A
EOSD4030 (0.998/<20 Min)	0.9999693	0.08	0.9999693	0.08	0.9999693	0.08

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Appendix A. Availability Data Worksheets/Block Diagrams and Analytical Results

Availability Data Worksheets using Excel format are shown in Appendix A and presented in availability requirement number sequence. Each requirement contains the following information:

Column Title	Description
Rel	Release identification of this system's architecture (eg. A, B, etc.)
Site	The DAAC site where the equipment is located.
Subsys Descrip	Subsystem Description
Equipment Description	Brief description of the equipment
Model/Part Number	The manufacturer's equipment model number and/or part number
MTBF	Mean Time Between Failure in hours
MTTR	Mean Time To Repair in hours
Admin Logis Delay Time	Administration Logistics Delay Time (ALDT) in hours
Switchover Time	Time required to switch from failed item to a back-up redundant item in minutes (where applicable)
Total Downtime	The MTTR + ALDT in hours
# of Units Rqrd	Minimum Number of Units Required (m) to be operational for the function to succeed
Total # of Units	Total number of units available (n)
Redundance	The type of redundant unit (i.e. standby off-line, hot, cold; where applicable)
Unit Availability	Availability (A_i) of unit
P	Probability of successful switchover to the redundandant unit (P=1.0; where applicable)

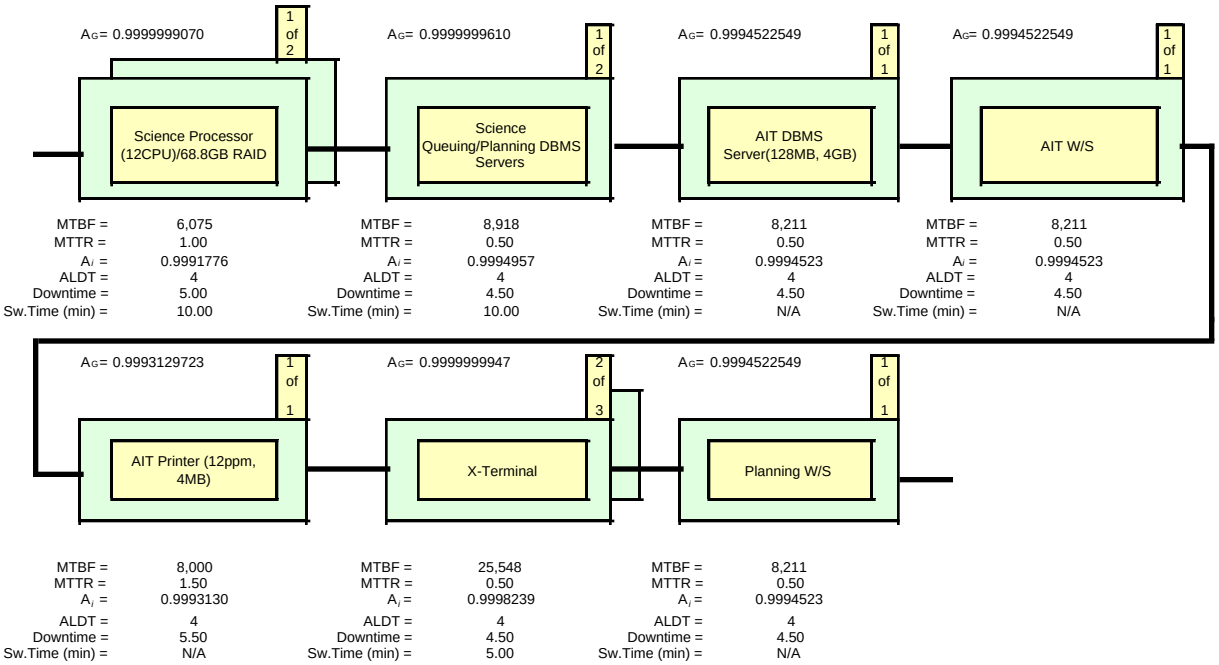
Redundant Group Availability	Group Availability with redundant items (m out of n) either on-line or off-line standby with repair
Last line totals	RMA requirement number; Total function's Availability (A_O) and MDT in hours

EOSD 3700 Ao/MDT Analytical Results for LaRC

EOSD3700: Derived Function of Planning and Data Processing

Rel	Site	Subsys Descrip	Equipment Description	Model/Part Number	MTBF (hour)	MTTR (hour)	Admin Logis Delay Time (hour)	Switch-over Time (min)	Total Down-time (hour)	# of Units Rqrd (m)	Total # Of Units (n)	Redundancy	Unit Availability (Ai)	P	Redundant Group Availability (m out of n)
A	LaRC	Science Proc,	Science Processor (12CPU)/68.8GB RAID	SGI PC XL/SGI RAID 5	6,075	1.00	4	10.00	5.00	1	2	standby off-line	0.9991776	1.0	0.9999999
A	LaRC	Science Proc,	Science Queuing/Planning DBMS Servers	SUN Sparc 20/71	8,918	0.50	4	10.00	4.50	1	2	standby off-line	0.9994957	1.0	1.0000000
A	LaRC	Science Proc,	AIT DBMS Server(128MB, 4GB)	SUN Sparc 20/50	8,211	0.50	4	N/A	4.50	1	1	N/A	0.9994523	N/A	0.9994523
A	LaRC	Science Proc,	AIT W/S	SUN Sparc 20/51	8,211	0.50	4	N/A	4.50	1	1	N/A	0.9994523	N/A	0.9994523
A	LaRC	Science Proc,	AIT Printer (12ppm, 4MB)	HP Laser Jet	8,000	1.50	4	N/A	5.50	1	1	N/A	0.9993130	N/A	0.9993130
A	LaRC	Planning	X-Terminal	NCD	25,548	0.50	4	5.00	4.50	2	3	standby off-line	0.9998239	1.0	1.0000000
A	LaRC	Planning	Planning W/S	SUN Sparc 20/50	8,211	0.50	4	N/A	4.50	1	1	N/A	0.9994523	N/A	0.9994523

EOSD3700: Ao = 0.997671628
MDT = 2.95321448

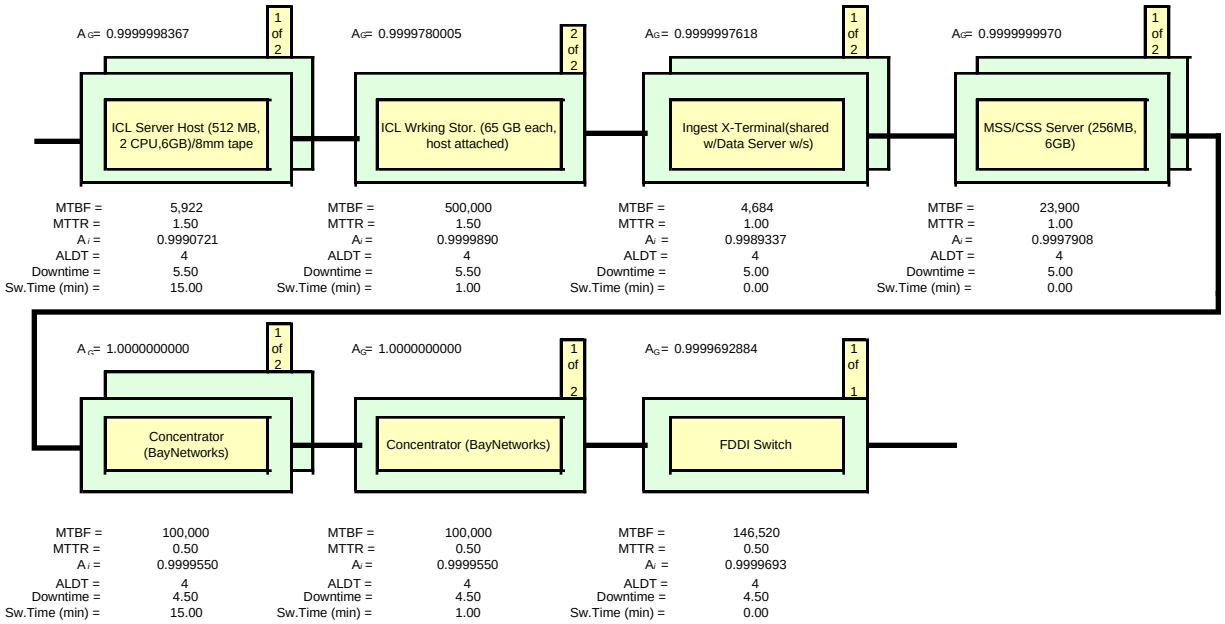


EOSD 3900 Ao/MDT Analytical Results for LaRC

EOSD3900: Function of Receiving Science Data

Rel	Site	Subsys Descrip	Equipment Description	Model/Part Number	MTBF (hour)	MTTR (hour)	Admin Logis Delay Time (hour)	Switch-over Time (min)	Total Down-time (hour)	# of Units Rqrd (m)	Total # Of Units (n)	Redundancy	Unit Availability (Ai)	P	Redundant Group Availability (m out of n)
A	LaRC	Ingest	ICL Server Host (512 MB, 2 CPU,6GB)/8mm tape	SGI Challenge L/Exabyte	5,922	1.50	4	15.00	5.50	1	2	standby off-line	0.9990721	1.0	0.9999998
A	LaRC	Ingest	ICL Wrking Stor. (65 GB each, host attached)	SGI RAID 5	500,000	1.50	4	N/A	5.50	2	2	N/A	0.9999890	N/A	0.9999780
A	LaRC	Ingest	Ingest X-Terminal(shared w/Data Server w/s)	NCD Xterm	4,684	1.00	4	15.00	5.00	1	2	standby off-line	0.9989337	1.0	0.9999998
A	LaRC	LSM	MSS/CSS Server (256MB, 6GB)	HP755/125	23,900	1.00	4	5.00	5.00	1	2	standby off-line	0.9997908	1.0	1.0000000
A	LaRC	ISS	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	LaRC	ISS	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	LaRC	ISS	FDDI Switch	Atlantec Power Hub 7000	146,520	0.50	4	10.00	4.50	1	1	N/A	0.9999693	N/A	0.9999693

EOSD3900: Ao = 0.999946885
MDT = 0.246227726



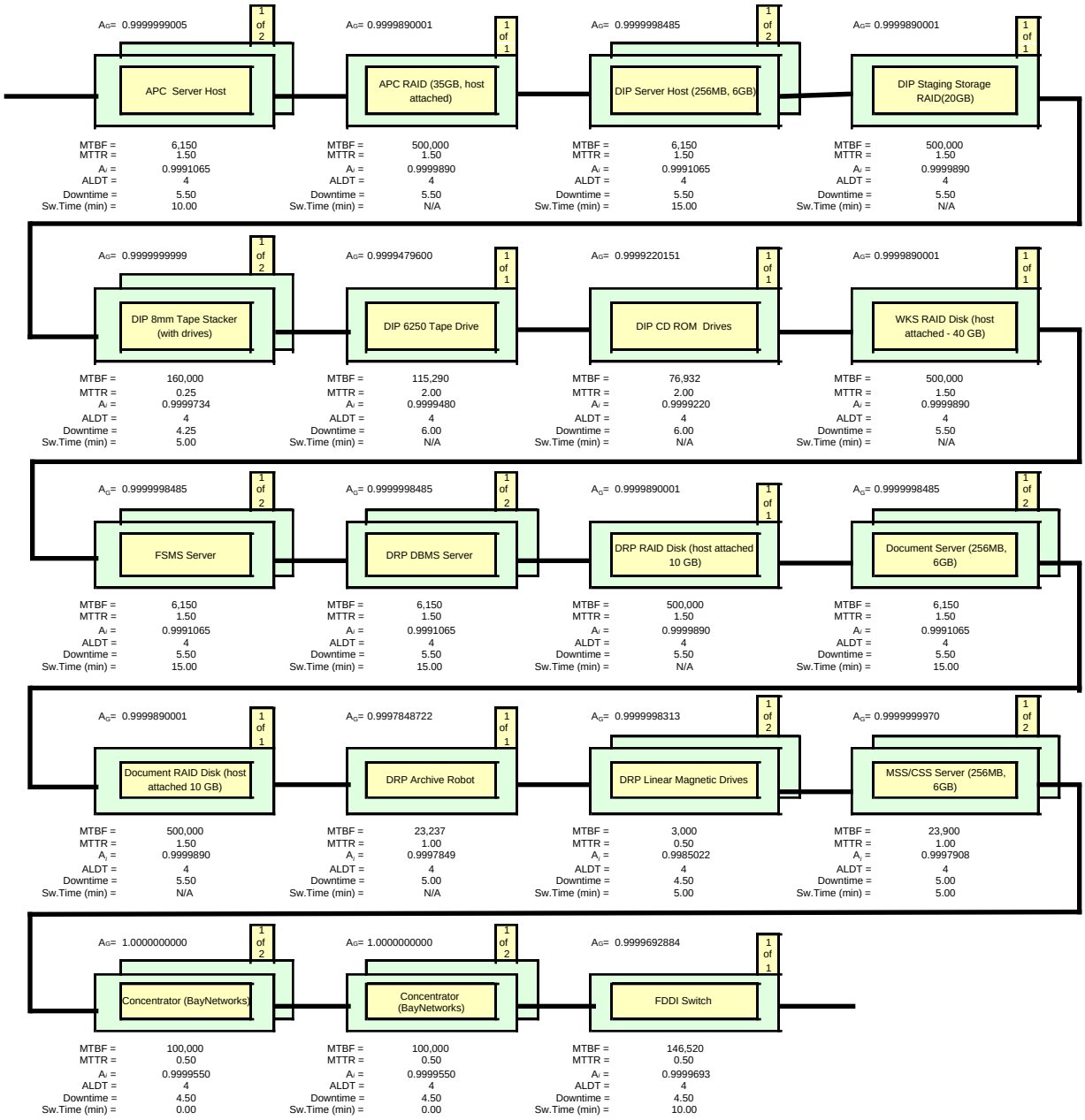
EOSD 3920 Ao/MDT Analytical Results for LaRC

EOSD3920: Function Of Archiving and Distributing Data

Rel	Site	Subsys Descrip	Equipment Description	Model/Part Number	MTBF (hour)	MTTR (hour)	Admin Logis Delay Time (hour)	Switch-over Time (min)	Total Down-time (hour)	# of Units Rqrd (m)	Total # Of Units (n)	Redundancy	Unit Availability (Ai)	P	Redundant Group Availability (m out of n)
A	LaRC	Data Server	APC Server Host	SGI Challenge L	6,150	1.50	4	10.00	5.50	1	2	standby off-line	0.9991065	1.0	0.9999999
A	LaRC	Data Server	APC RAID (35GB, host attached)	SGI RAID 5	500,000	1.50	4	N/A	5.50	1	1	N/A	0.9999890	N/A	0.9999890
A	LaRC	Data Server	DIP Server Host (256MB, 6GB)	Sun Sparc 20/712	6,150	1.50	4	15.00	5.50	1	2	standby off-line	0.9991065	1.0	0.9999998
A	LaRC	Data Server	DIP Staging Storage RAID(20GB)	SGI RAID 5	500,000	1.50	4	N/A	5.50	1	1	N/A	0.9999890	N/A	0.9999890
A	LaRC	Data Server	DIP 8mm Tape Stacker (with drives)	Exabyte EXB-210	160,000	0.25	4	5.00	4.25	1	2	standby off-line	0.9999734	1.0	1.0000000
A	LaRC	Data Server	DIP 6250 Tape Drive	SUN 6250 (X680A)	115,290	2.00	4	N/A	6.00	1	1	N/A	0.9999480	N/A	0.9999480
A	LaRC	Data Server	DIP CD ROM Drives	N/A	76,932	2.00	4	N/A	6.00	1	1	N/A	0.9999220	N/A	0.9999220
A	LaRC	Data Server	WKS RAID Disk (host attached - 40 GB)	SGI RAID 5	500,000	1.50	4	N/A	5.50	1	1	N/A	0.9999890	N/A	0.9999890
A	LaRC	Data Server	FSMS Server	SGI Challenge XL	6,150	1.50	4	15.00	5.50	1	2	standby off-line	0.9991065	1.0	0.9999998
A	LaRC	Data Server	DRP DBMS Server	SGI Challenge XL	6,150	1.50	4	15.00	5.50	1	2	standby off-line	0.9991065	1.0	0.9999998
A	LaRC	Data Server	DRP RAID Disk (host attached 10 GB)	SGI RAID 5	500,000	1.50	4	N/A	5.50	1	1	N/A	0.9999890	N/A	0.9999890
A	LaRC	Data Server	Document Server (256MB, 6GB)	SUN Sparc 20/712	6,150	1.50	4	15.00	5.50	1	2	standby off-line	0.9991065	1.0	0.9999998
A	LaRC	Data Server	Document RAID Disk (host attached 10 GB)	SGI RAID 5	500,000	1.50	4	N/A	5.50	1	1	N/A	0.9999890	N/A	0.9999890
A	LaRC	Data Server	DRP Archive Robot	Bosch AMASS EML/2	23,237	1.00	4	N/A	5.00	1	1	N/A	0.9997849	N/A	0.9997849
A	LaRC	Data Server	DRP Linear Magnetic Drives	IBM-MagStar 3590 (NTP)	3,000	0.50	4	5.00	4.50	1	2	standby off-line	0.9985022	1.0	0.9999998
A	LaRC	LSM	MSS/CSS Server (256MB, 6GB)	HP755/125	23,900	1.00	4	5.00	5.00	1	2	standby off-line	0.9997908	1.0	1.0000000
A	LaRC	Comm. Equ	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	LaRC	Comm. Equ	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	LaRC	Comm. Equ	FDDI Switch	Atlantec Power Hub 7000	146,520	0.50	4	10.00	4.50	1	1	N/A	0.9999693	N/A	0.9999693

EOSD3920: Ao = 0.999568324
MDT = 0.480850955

EOSD 3920 Ao/MDT Analytical Results for LaRC (continued)



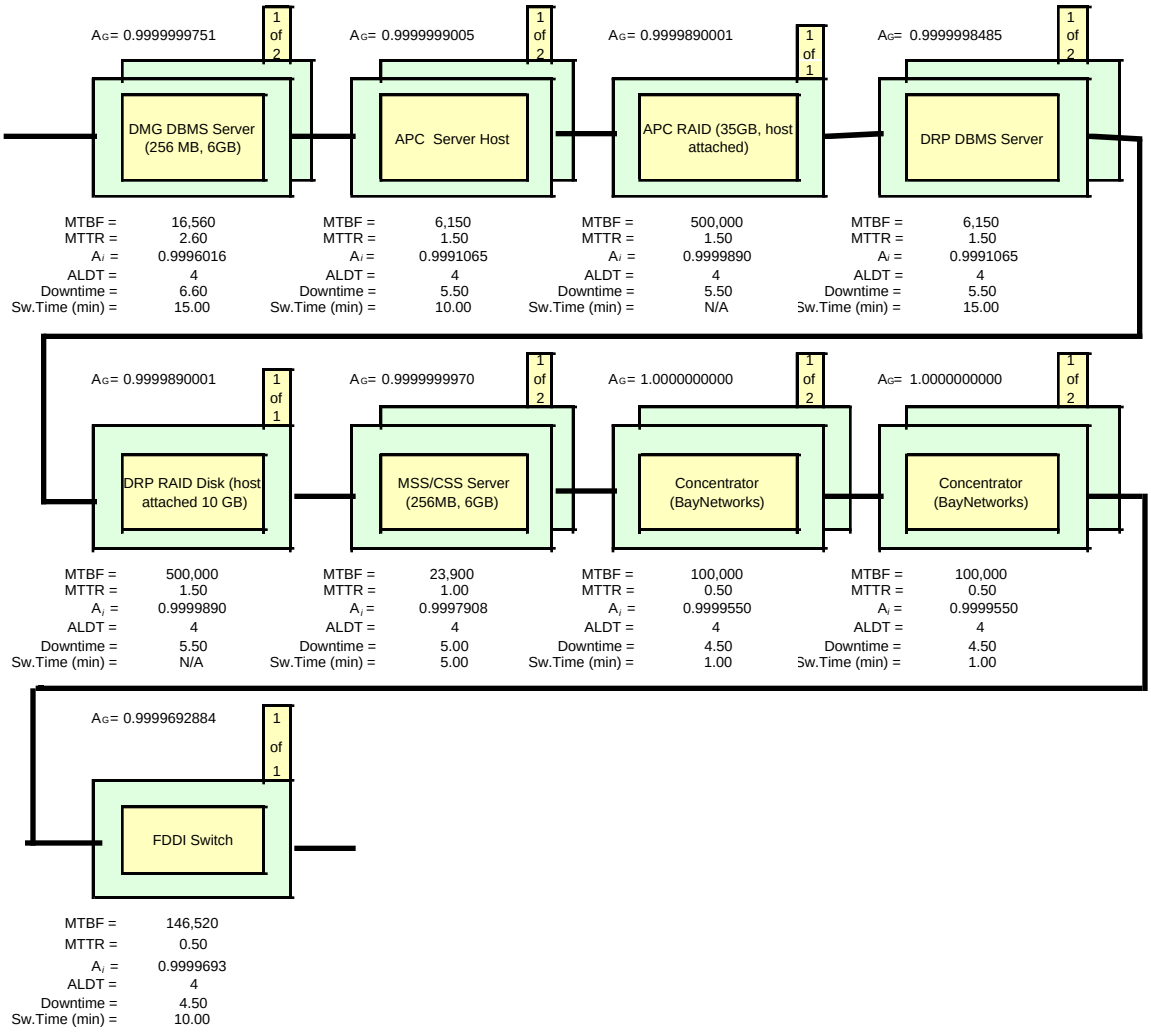
EOSD 3930 Ao/MDT Analytical Results for LaRC

EOSD3930: User Interfaces to IMS Services at Individual DAAC Site

Rel	Site	Subsys Descrip	Equipment Description	Model/Part Number	MTBF (hour)	MTTR (hour)	Admin. Logis Delay Time (hour)	Switch-over Time (min)	Total Down-time (hour)	# of Units Rqrd (m)	Total # Of Units (n)	Redundancy	Unit Availability (Ai)	P	Redundant Group Availability (m out of n)
A	LaRC	Data Manag.	DMG DBMS Server (256 MB, 6GB)	HP K200/1	16,560	2.60	4	15.00	6.60	1	2	standby off-line	0.9996016	1.0	1.0000000
A	LaRC	Data Server	APC Server Host	SGI Challenge L	6,150	1.50	4	10.00	5.50	1	2	standby off-line	0.9991065	1.0	0.9999999
A	LaRC	Data Server	APC RAID (35GB, host attached)	SGI RAID 5	500,000	1.50	4	N/A	5.50	1	1	N/A	0.9999890	N/A	0.9999890
A	LaRC	Data Server	DRP DBMS Server	SGI Challenge XL	6,150	1.50	4	15.00	5.50	1	2	standby off-line	0.9991065	1.0	0.9999998
A	LaRC	Data Server	DRP RAID Disk (host attached 10 GB)	SGI RAID 5	500,000	1.50	4	N/A	5.50	1	1	N/A	0.9999890	N/A	0.9999890
A	LaRC	LSM	MSS/CSS Server (256MB, 6GB)	HP755/125	23,900	1.00	4	5.00	5.00	1	2	standby off-line	0.9997908	1.0	1.0000000
A	LaRC	ISS	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	LaRC	ISS	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	LaRC	ISS	FDDI Switch	Atlantec Power Hub 7000	146,520	0.50	4	10.00	4.50	1	1	N/A	0.9999693	N/A	0.9999693

EOSD3930: Ao = 0.999947011
MDT = 0.239614852

EOSD 3930 Ao/MDT Analytical Results for LaRC (continued)

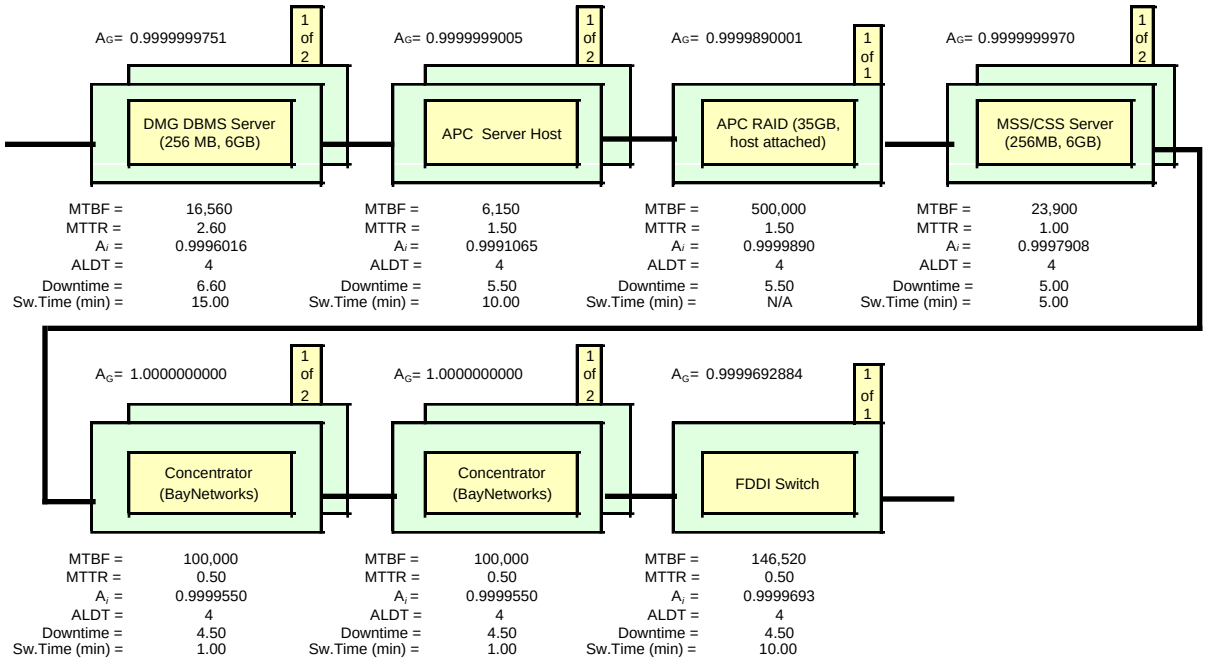


EOSD 3940 Ao/MDT Analytical Results for LaRC

EOSD3940: Function Of Information Searches On The ECS Directory

Rel	Site	Subsys Descrip	Equipment Description	Model/Part Number	MTBF (hour)	MTTR (hour)	Admin Logis Delay Time (hour)	Switch-over Time (min)	Total Down-time (hour)	# of Units Rqrd (m)	Total # Of Units (n)	Redundancy	Unit Availability (Ai)	P	Redundant Group Availability (m out of n)
A	LaRC	Data Manag.	DMG DBMS Server (256 MB, 6GB)	HP K200/1	16,560	2.60	4	15.00	6.60	1	2	standby off-line	0.9996016	1.0	1.0000000
A	LaRC	Data Server	APC Server Host	SGI Challenge L	6,150	1.50	4	10.00	5.50	1	2	standby off-line	0.9991065	1.0	0.9999999
A	LaRC	Data Server	APC RAID (35GB, host attached)	SGI RAID 5	500,000	1.50	4	N/A	5.50	1	1	N/A	0.9999890	N/A	0.9999890
A	LaRC	LSM	MSS/CSS Server (256MB, 6GB)	HP755/125	23,900	1.00	4	5.00	5.00	1	2	standby off-line	0.9997908	1.0	1.0000000
A	LaRC	ISS	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	LaRC	ISS	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	LaRC	ISS	FDDI Switch	Atlantec Power Hub 7000	146,520	0.50	4	10.00	4.50	1	1	N/A	0.9999693	N/A	0.9999693

EOSD3940: Ao = 0.999958161
MDT = 0.198037324



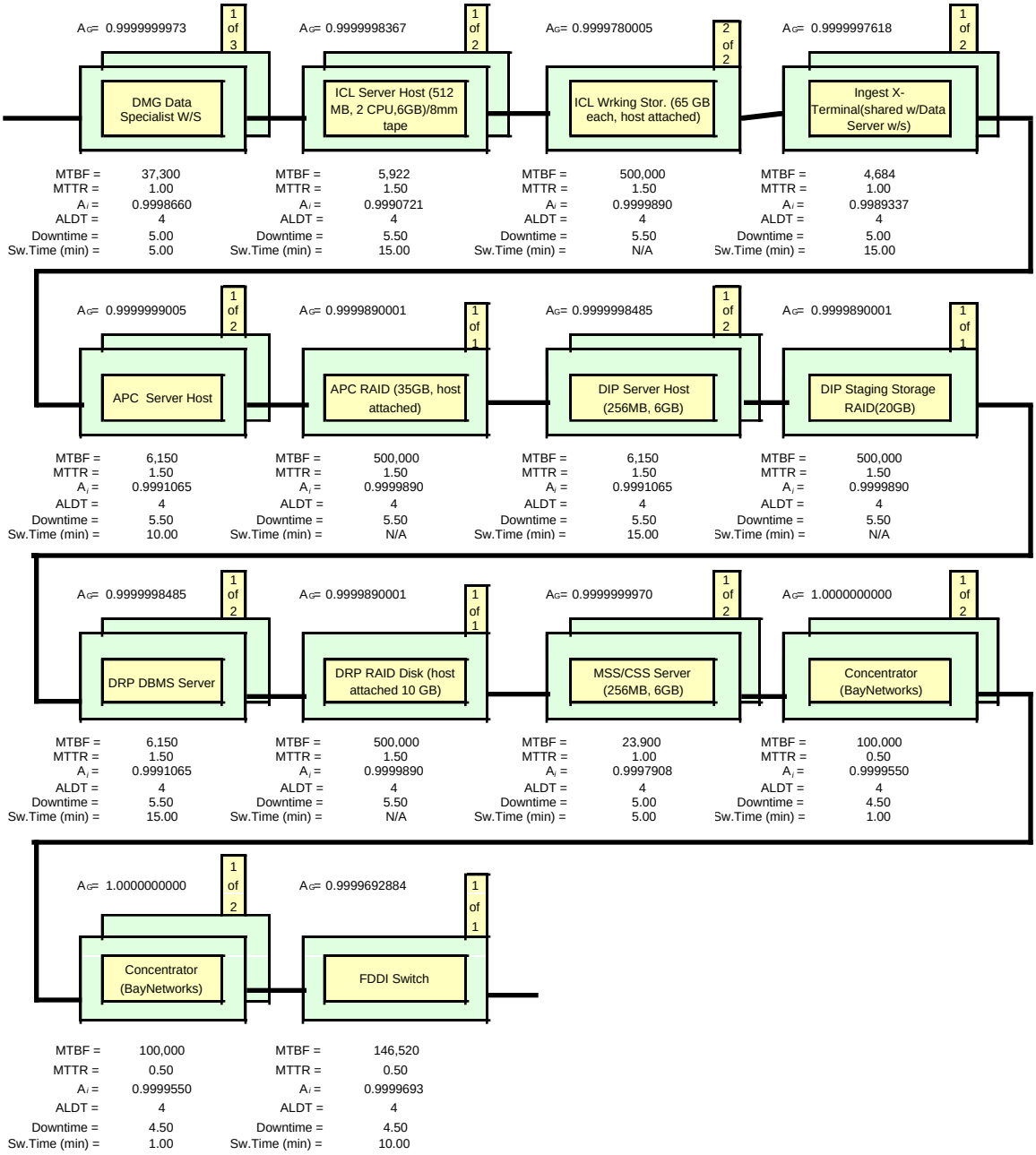
EOSD 3960 Ao/MDT Analytical Results for LaRC

EOSD3960: Function Of MetaData Ingest and Update

Rel	Site	Subsys Descrip	Equipment Description	Model/Part Number	MTBF (hour)	MTTR (hour)	Admin Logis Delay Time (hour)	Switch-over Time (min)	Total Down-time (hour)	# of Units Rqrd (m)	Total # Of Units (n)	Redundancy	Unit Availability (Ai)	P	Redundant Group Availability (m out of n)
A	LaRC	Data Manag.	DMG Data Specialist W/S	Sun Sparc 20/50	37,300	1.00	4	5.00	5.00	1	3	standby off-line	0.9998660	1.0	1.0000000
A	LaRC	Ingest	ICL Server Host (512 MB, 2 CPU,6GB)/8mm tape	SGI Challenge L/Exabyte	5,922	1.50	4	15.00	5.50	1	2	standby off-line	0.9990721	1.0	0.9999998
A	LaRC	Ingest	ICL Wrking Stor. (65 GB each, host attached)	SGI RAID 5	500,000	1.50	4	N/A	5.50	2	2	N/A	0.9999890	N/A	0.9999780
A	LaRC	Ingest	Ingest X-Terminal(shared w/Data Server w/s)	NCD Xterm	4,684	1.00	4	15.00	5.00	1	2	standby off-line	0.9989337	1.0	0.9999998
A	LaRC	Data Server	APC Server Host	SGI Challenge L	6,150	1.50	4	10.00	5.50	1	2	standby off-line	0.9991065	1.0	0.9999999
A	LaRC	Data Server	APC RAID (35GB, host attached)	SGI RAID 5	500,000	1.50	4	N/A	5.50	1	1	N/A	0.9999890	N/A	0.9999890
A	LaRC	Data Server	DIP Server Host (256MB, 6GB)	Sun Sparc 20/712	6,150	1.50	4	15.00	5.50	1	2	standby off-line	0.9991065	1.0	0.9999998
A	LaRC	Data Server	DIP Staging Storage RAID(20GB)	SGI RAID 5	500,000	1.50	4	N/A	5.50	1	1	N/A	0.9999890	N/A	0.9999890
A	LaRC	Data Server	DRP DBMS Server	SGI Challenge XL	6,150	1.50	4	15.00	5.50	1	2	standby off-line	0.9991065	1.0	0.9999998
A	LaRC	Data Server	DRP RAID Disk (host attached 10 GB)	SGI RAID 5	500,000	1.50	4	N/A	5.50	1	1	N/A	0.9999890	N/A	0.9999890
A	LaRC	LSM	MSS/CSS Server (256MB, 6GB)	HP755/125	23,900	1.00	4	5.00	5.00	1	2	standby off-line	0.9997908	1.0	1.0000000
A	LaRC	ISS	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	LaRC	ISS	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	LaRC	ISS	FDDI Switch	Atlantec Power Hub 7000	146,520	0.50	4	10.00	4.50	1	1	N/A	0.9999693	N/A	0.9999693

EOSD3960: Ao = 0.999913482
MDT = 0.262091461

EOSD 3960 Ao/MDT Analytical Results for LaRC (continued)

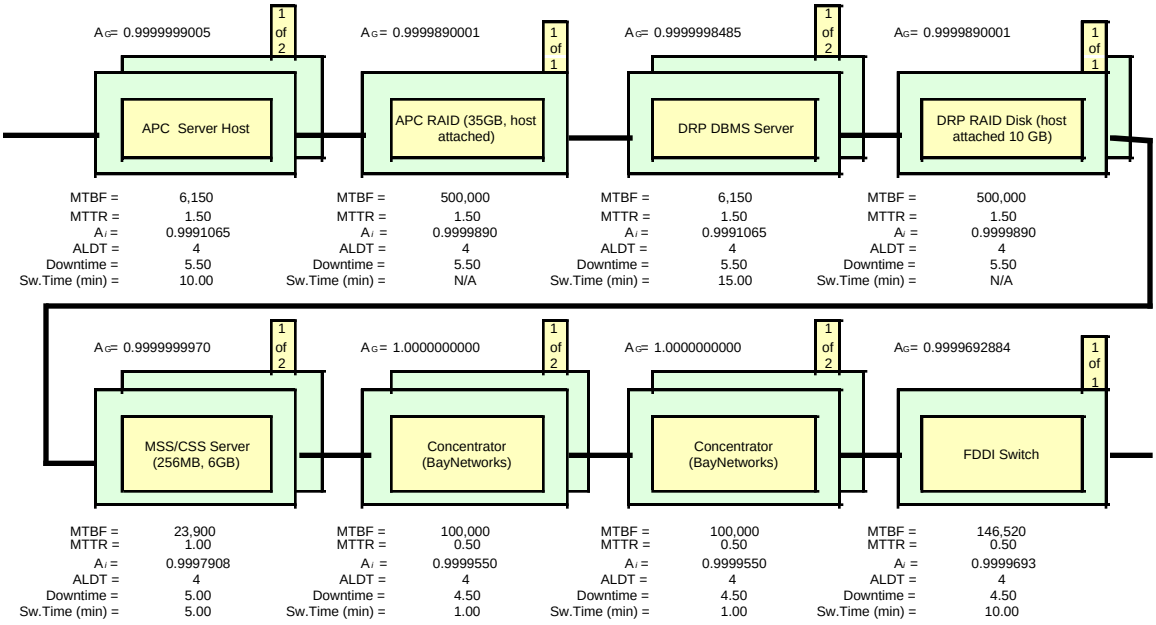


EOSD 3970 Ao/MDT Analytical Results for LaRC

EOSD3970: Function Of Info. Searches On Local Holdings

Rel	Site	Subsys Descrip	Equipment Description	Model/Part Number	MTBF (hour)	MTTR (hour)	Admin Logis Delay Time (hour)	Switch-over Time (min)	Total Down-time (hour)	# of Units Rqrd (m)	Total # Of Units (n)	Redundancy	Unit Availability (Ai)	P	Redundant Group Availability (m out of n)
A	LaRC	Data Server	APC Server Host	SGI Challenge L	6,150	1.50	4	10.00	5.50	1	2	standby off-line	0.9991065	1.0	0.9999999
A	LaRC	Data Server	APC RAID (35GB, host attached)	SGI RAID 5	500,000	1.50	4	N/A	5.50	1	1	N/A	0.9999890	N/A	0.9999890
A	LaRC	Data Server	DRP DBMS Server	SGI Challenge XL	6,150	1.50	4	15.00	5.50	1	2	standby off-line	0.9991065	1.0	0.9999998
A	LaRC	Data Server	DRP RAID Disk (host attached 10 GB)	SGI RAID 5	500,000	1.50	4	N/A	5.50	1	1	N/A	0.9999890	N/A	0.9999890
A	LaRC	LSM	MSS/CSS Server (256MB, 6GB)	HP755/125	23,900	1.00	4	5.00	5.00	1	2	standby off-line	0.9997908	1.0	1.0000000
A	LaRC	ISS	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	LaRC	ISS	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	LaRC	ISS	FDDI Switch	Atlantec Power Hub 7000	146,520	0.50	4	10.00	4.50	1	1	N/A	0.9999693	N/A	0.9999693

EOSD3970: Ao = 0.999947035
MDT = 0.23803865

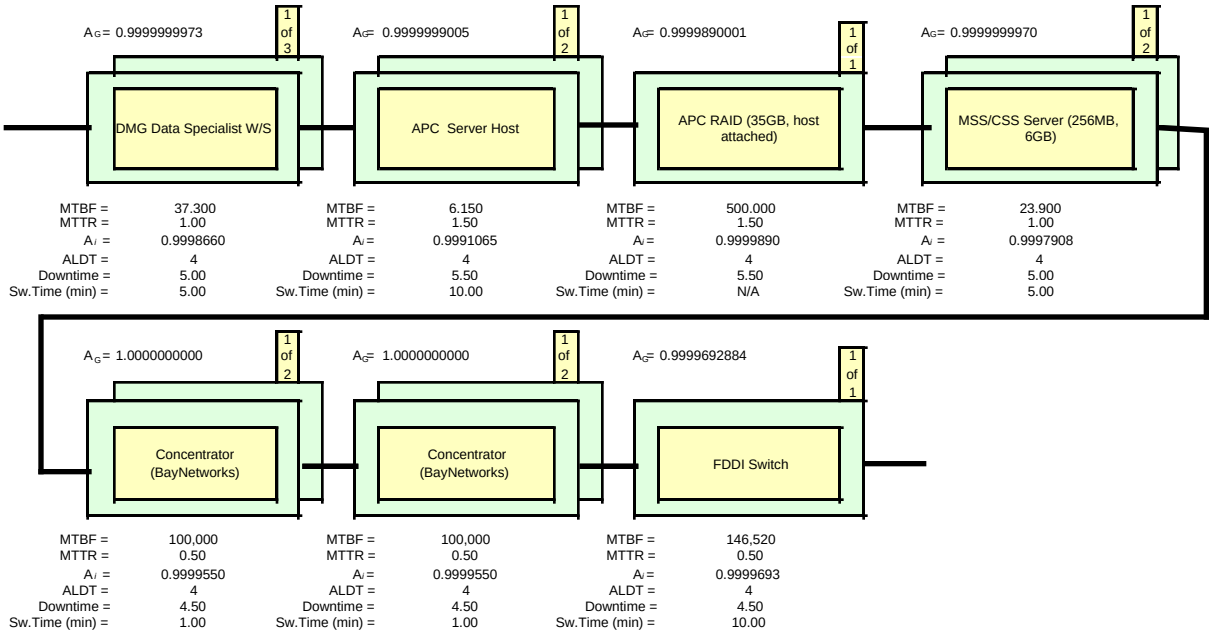


EOSD 3980 Ao/MDT Analytical Results for LaRC

EOSD3980: Function Of Local Data Order Submission

Rel	Site	Subsys Descrip	Equipment Description	Model/Part Number	MTBF (hour)	MTTR (hour)	Admin Logis Delay Time (hour)	Switch-over Time (min)	Total Down-time (hour)	# of Units Rqrd (m)	Total # Of Units (n)	Redundancy	Unit Availability (Ai)	P	Redundant Group Availability (m out of n)
A	LaRC	Data Manag.	DMG Data Specialist W/S	Sun Sparc 20/50	37,300	1.00	4	5.00	5.00	1	3	standby off-line	0.9998660	1.0	1.0000000
A	LaRC	Data Server	APC Server Host	SGI Challenge L	6,150	1.50	4	10.00	5.50	1	2	standby off-line	0.9991065	1.0	0.9999999
A	LaRC	Data Server	APC RAID (35GB, host attached)	SGI RAID 5	500,000	1.50	4	N/A	5.50	1	1	N/A	0.9999890	N/A	0.9999890
A	LaRC	LSM	MSS/CSS Server (256MB, 6GB)	HP755/125	23,900	1.00	4	5.00	5.00	1	2	standby off-line	0.9997908	1.0	1.0000000
A	LaRC	ISS	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	LaRC	ISS	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	LaRC	ISS	FDDI Switch	Atlantec Power Hub 7000	146,520	0.50	4	10.00	4.50	1	1	N/A	0.9999693	N/A	0.9999693

EOSD3980: Ao = 0.999958184
MDT = 0.174148207

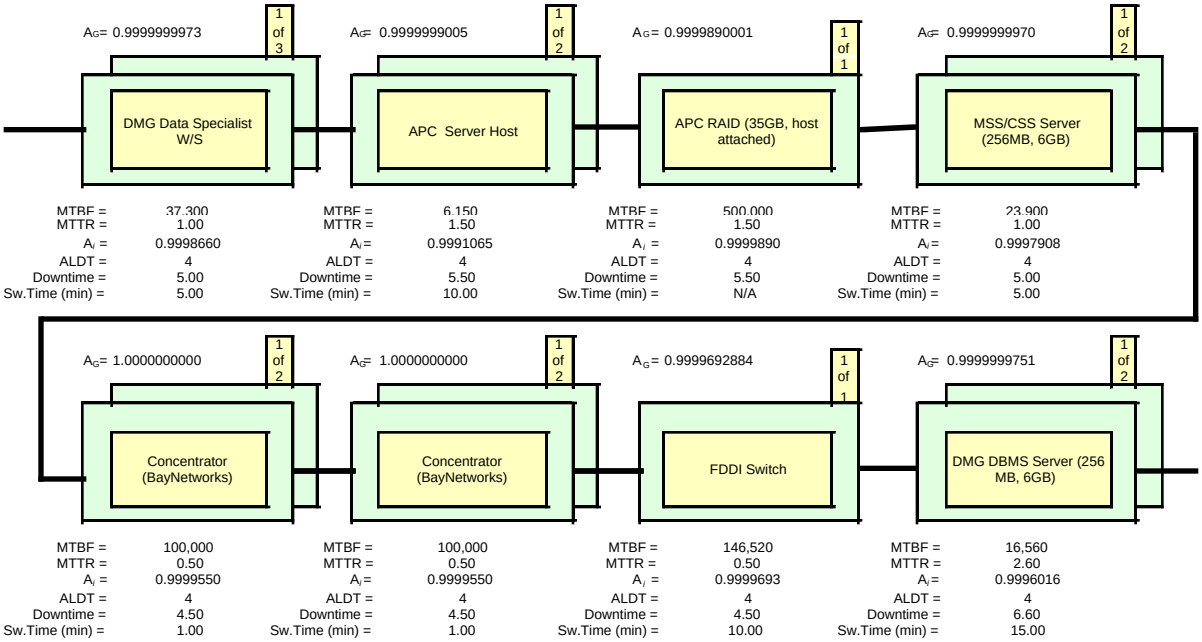


EOSD 3990 Ao/MDT Analytical Results for LaRC

EOSD3990: Function Of Data Order Submission Across DAACs

Rel	Site	Subsys Descrip	Equipment Description	Model/Part Number	MTBF (hour)	MTTR (hour)	Admin Logis Delay Time (hour)	Switch-over Time (min)	Total Down-time (hour)	# of Units Rqrd (m)	Total # Of Units (n)	Redundancy	Unit Availability (Ai)	P	Redundant Group Availability (m out of n)
A	LaRC	Data Manag.	DMG DBMS Server (256 MB, 6GB)	HP K200/1	16,560	2.60	4	15.00	6.60	1	2	standby off-line	0.9996016	1.0	1.0000000
A	LaRC	Data Manag.	DMG Data Specialist W/S	Sun Sparc 20/50	37,300	1.00	4	5.00	5.00	1	3	standby off-line	0.9998660	1.0	1.0000000
A	LaRC	Data Server	APC Server Host	SGI Challenge L	6,150	1.50	4	10.00	5.50	1	2	standby off-line	0.9991065	1.0	0.9999999
A	LaRC	Data Server	APC RAID (35GB, host attached)	SGI RAID 5	500,000	1.50	4	N/A	5.50	1	1	N/A	0.9999890	N/A	0.9999890
A	LaRC	LSM	MSS/CSS Server (256MB, 6GB)	HP755/125	23,900	1.00	4	5.00	5.00	1	2	standby off-line	0.9997908	1.0	1.0000000
A	LaRC	ISS	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	LaRC	ISS	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	LaRC	ISS	FDDI Switch	Atlantec Power Hub	146,520	0.50	4	10.00	4.50	1	1	N/A	0.9999693	N/A	0.9999693

EOSD3990: Ao = 0.999958159
MDT = 0.188441312



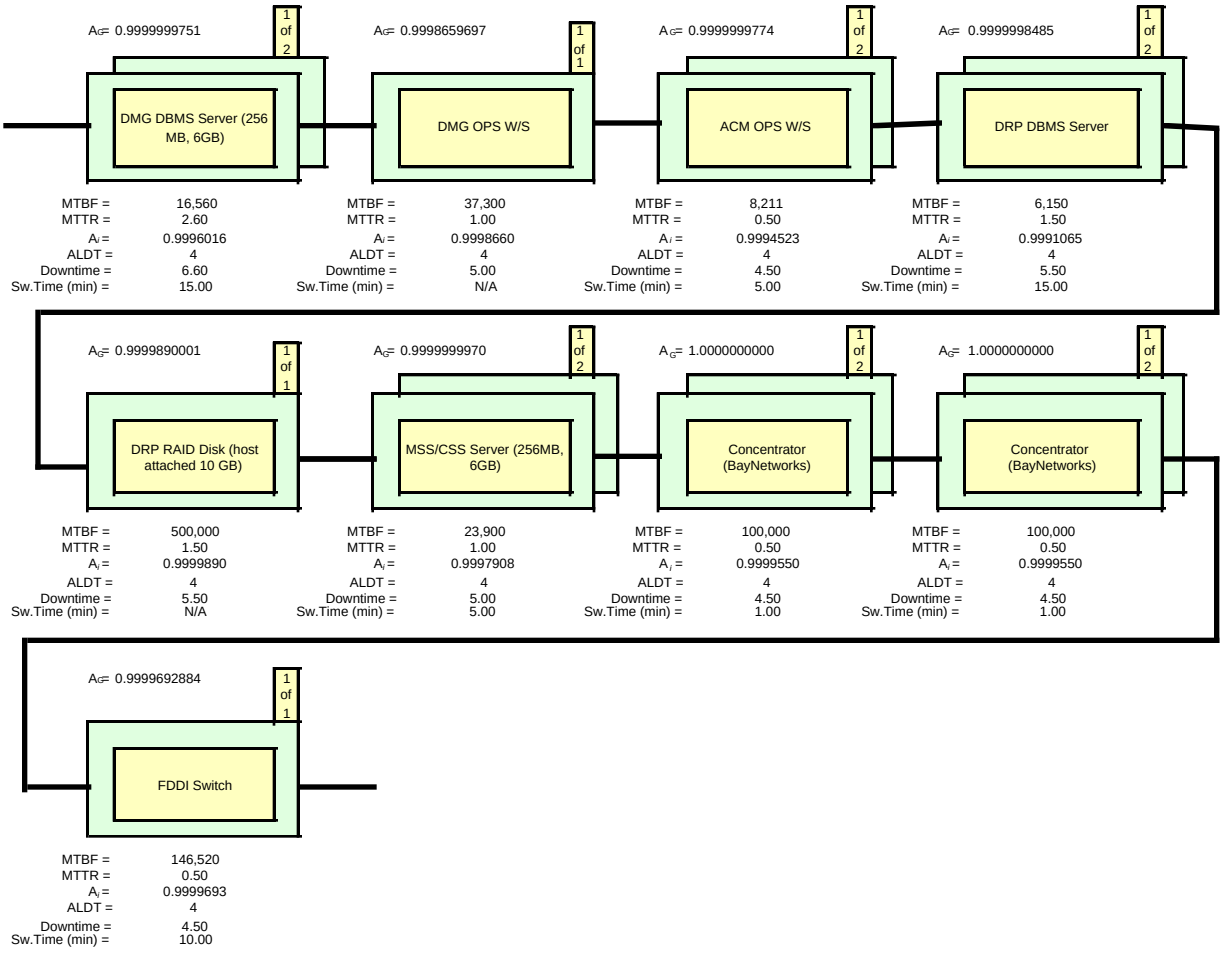
EOSD 4000 Ao/MDT Analytical Results for LaRC

EOSD4000: Function Of IMS Data Management and Maintenance Interface

Rel	Site	Subsys Descrip	Equipment Description	Model/Part Number	MTBF (hour)	MTTR (hour)	Admin Logis Delay Time (hour)	Switch-over Time (min)	Total Down-time (hour)	# of Units Rqrd (m)	Total # Of Units (n)	Redundancy	Unit Availability (Ai)	P	Redundant Group Availability (m out of n)
A	LaRC	Data Manag.	DMG DBMS Server (256 MB, 6GB)	HP K200/1	16,560	2.60	4	15.00	6.60	1	2	standby off-line	0.9996016	1.0	1.0000000
A	LaRC	Data Manag.	DMG OPS W/S	HP 715/64	37,300	1.00	4	N/A	5.00	1	1	N/A	0.9998660	N/A	0.9998660
A	LaRC	Data Server	ACM OPS W/S	Sun Sparc 20/50	8,211	0.50	4	5.00	4.50	1	2	standby off-line	0.9994523	1.0	1.0000000
A	LaRC	Data Server	DRP DBMS Server	SGI Challenge XL	6,150	1.50	4	15.00	5.50	1	2	standby off-line	0.9991065	1.0	0.9999998
A	LaRC	Data Server	DRP RAID Disk (host attached 10 GB)	SGI RAID 5	500,000	1.50	4	N/A	5.50	1	1	N/A	0.9999890	N/A	0.9999890
A	LaRC	LSM	MSS/CSS Server (256MB, 6GB)	HP755/125	23,900	1.00	4	5.00	5.00	1	2	standby off-line	0.9997908	1.0	1.0000000
A	LaRC	ISS	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	LaRC	ISS	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	LaRC	ISS	FDDI Switch	Atlantec Power Hub 7000	146,520	0.50	4	10.00	4.50	1	1	N/A	0.9999693	N/A	0.9999693

EOSD4000: Ao = 0.999824062
MDT = 0.488187834

EOSD 4000 Ao/MDT Analytical Results for LaRC

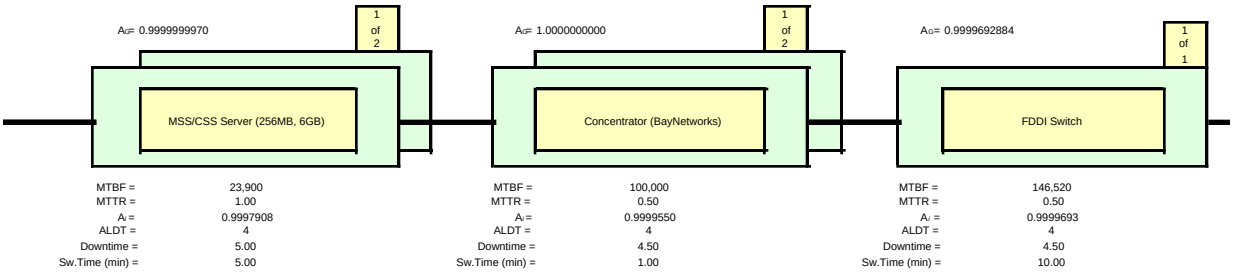


EOSD 4030 Ao/MDT Analytical Results for LaRC

EOSD4030: Function Of Gathering and Disseminating System Management Information

Rel	Site	Subsys Descrip	Equipment Description	Model/Part Number	MTBF (hour)	MTTR (hour)	Admin Logis Delay Time (hour)	Switch-over Time (min)	Total Down-time (hour)	# of Units Rqrd (m)	Total # Of Units (n)	Redundancy	Unit Availability (Ai)	P	Redundant Group Availability (m out of n)
A	LaRC	LSM	MSS/CSS Server (256MB, 6GB)	HP755/125	23,900	1.00	4	5.00	5.00	1	2	standby off-line	0.9997908	1.0	1.0000000
A	LaRC	ISS	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	LaRC	ISS	FDDI Switch	Atlantec Power Hub 7000	146,520	0.50	4	10.00	4.50	1	1	N/A	0.9999693	N/A	0.9999693

EOSD4000: Ao = 0.999969285
MDT = 0.08166429



MTBF =	23,900	MTBF =	100,000
MTTR =	1.00	MTTR =	0.50
Ai =	0.9997908	Ai =	0.9999550
ALDT =	4	ALDT =	4
Downtime =	5.00	Downtime =	4.50
Sw.Time (min) =	5.00	Sw.Time (min) =	1.00

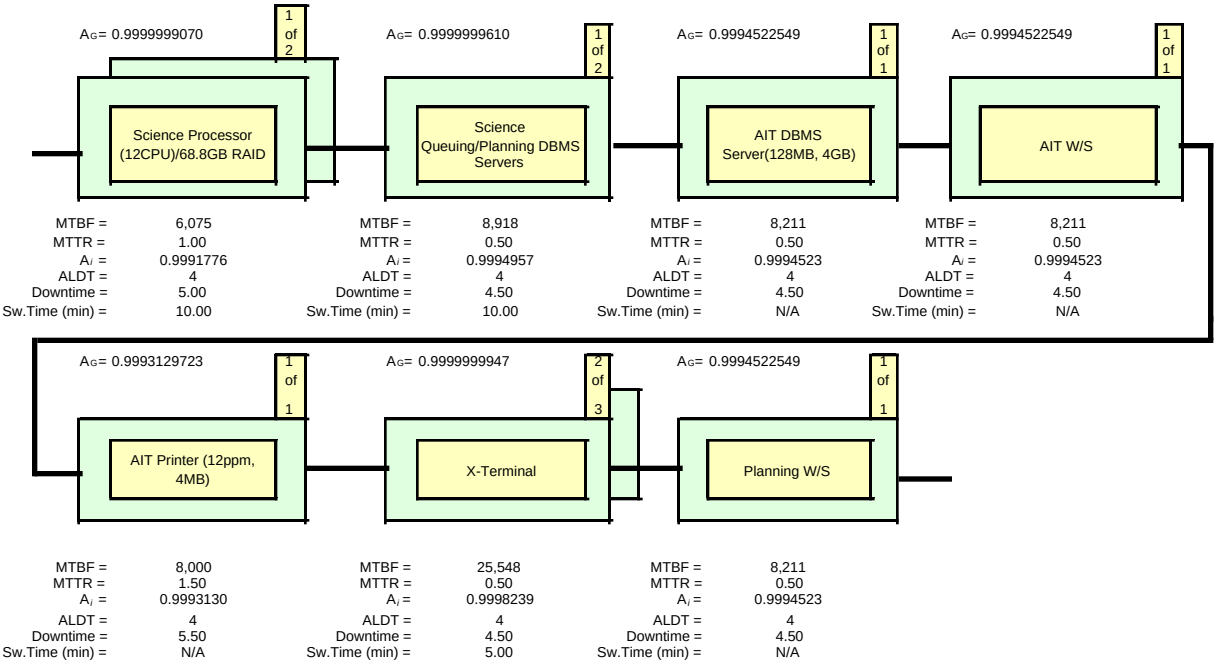
MTBF =	146,520
MTTR =	0.50
Ai =	0.9999693
ALDT =	4
Downtime =	4.50
Sw.Time (min) =	10.00

EOSD 3700 Ao/MDT Analytical Results for MSFC

EOSD3700: Derived Function of Planning and Data Processing

Rel	Site	Subsys Descrip	Equipment Description	Model/Part Number	MTBF (hour)	MTTR (hour)	Admin Logis Delay Time (hour)	Switch-over Time (min)	Total Down-time (hour)	# of Units Rqrd (m)	Total # Of Units (n)	Redundancy	Unit Availability (Ai)	P	Redundant Group Availability (m out of n)
A	MSFC	Science Proc,	Science Processor (12CPU)/68.8GB RAID	SGI PC XL/SGI RAID 5	6,075	1.00	4	10.00	5.00	1	2	standby off-line	0.9991776	1.0	0.9999999
A	MSFC	Science Proc,	Science Queuing/Planning DBMS Servers	SUN Sparc 20/71	8,918	0.50	4	10.00	4.50	1	2	standby off-line	0.9994957	1.0	1.0000000
A	MSFC	Science Proc,	AIT DBMS Server(128MB, 4GB)	SUN Sparc 20/50	8,211	0.50	4	N/A	4.50	1	1	N/A	0.9994523	N/A	0.9994523
A	MSFC	Science Proc,	AIT W/S	SUN Sparc 20/51	8,211	0.50	4	N/A	4.50	1	1	N/A	0.9994523	N/A	0.9994523
A	MSFC	Science Proc,	AIT Printer (12ppm, 4MB)	HP Laser Jet	8,000	1.50	4	N/A	5.50	1	1	N/A	0.9993130	N/A	0.9993130
A	MSFC	Planning	X-Terminal	NCD	25,548	0.50	4	5.00	4.50	2	3	standby off-line	0.9998239	1.0	1.0000000
A	MSFC	Planning	Planning W/S	SUN Sparc 20/50	8,211	0.50	4	N/A	4.50	1	1	N/A	0.9994523	N/A	0.9994523

EOSD3700: Ao = 0.997671628
MDT = 2.95321448

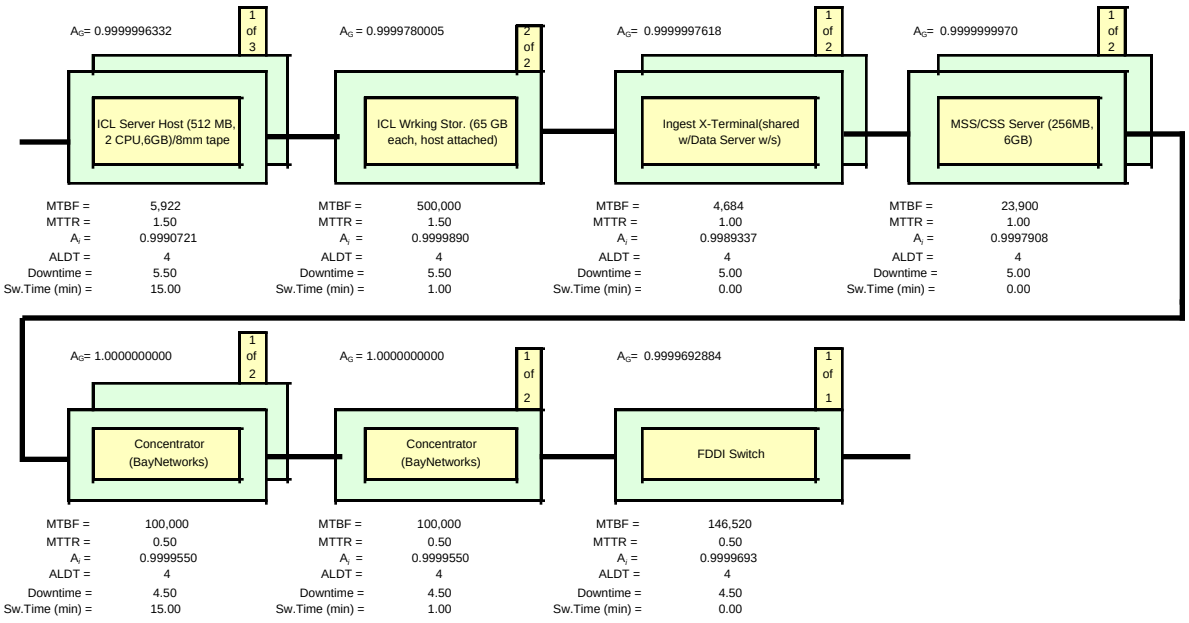


EOSD 3900 Ao/MDT Analytical Results for MSFC

EOSD3900: Function of Receiving Science Data

Rel.	Site	Subsys Descrip	Equipment Description	Model/Part Number	MTBF (hour)	MTTR (hour)	ALDT	Switch-over Time (min)	Total Down-time (hour)	# of Units Rqrd (m)	Total # Of Units (n)	Redundancy	Unit Availability (Ai)	P	Redundant Group Availability (m out of n)
A	MSFC	Ingest	ICL Server Host (512 MB, 2 CPU,6GB)/8mm tape	SGI Challenge L/Exabyte	5,922	1.50	4	15.00	5.50	1	3	standby off-line	0.9990721	1.0	0.9999996
A	MSFC	Ingest	ICL Wrking Stor. (65 GB each, host attached)	SGI RAID 5	500,000	1.50	4	N/A	5.50	2	2	N/A	0.9999890	N/A	0.9999780
A	MSFC	Ingest	Ingest X-Terminal(shared w/Data Server w/s)	NCD Xterm	4,684	1.00	4	15.00	5.00	1	2	standby off-line	0.9989337	1.0	0.9999998
A	MSFC	LSM	MSS/CSS Server (256MB, 6GB)	HP755/125	23,900	1.00	4	5.00	5.00	1	2	standby off-line	0.9997908	1.0	1.0000000
A	MSFC	ISS	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	MSFC	ISS	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	MSFC	ISS	FDDI Switch	Atlantec Power Hut 7000	146,520	0.50	4	10.00	4.50	1	1	N/A	0.9999693	N/A	0.9999693

EOSD3900: Ao = 0.999946682
MDT = 0.246227726



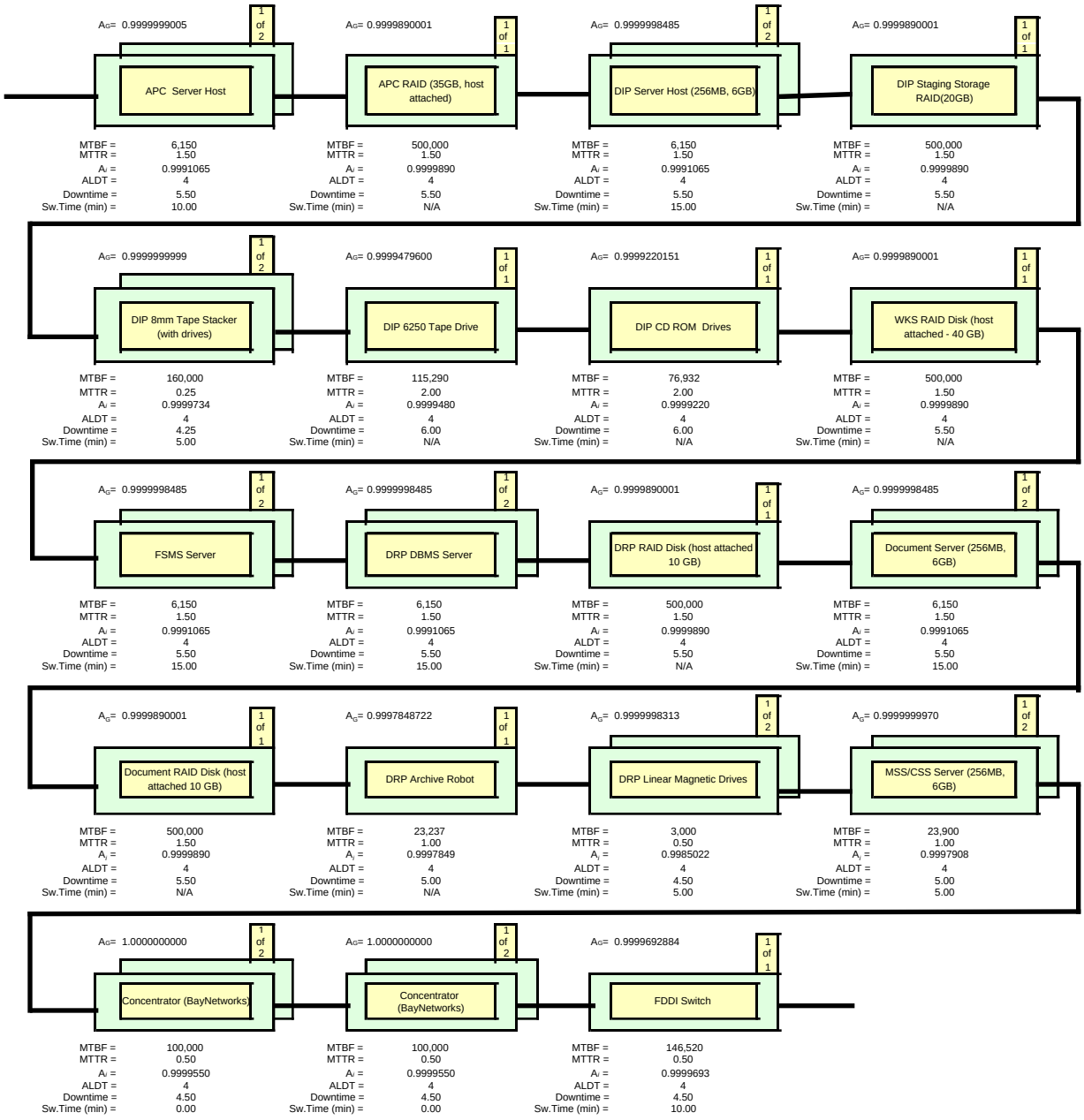
EOSD 3920 Ao/MDT Analytical Results for MSFC

EOSD3920: Function Of Archiving and Distributing Data

Rel	Site	Subsys Descrip	Equipment Description	Model/Part Number	MTBF (hour)	MTTR (hour)	Admin Logis Delay Time (hour)	Switch-over Time (min)	Total Down-time (hour)	# of Units Rqrd (m)	Total # Of Units (n)	Redundancy	Unit Availability (Ai)	P	Redundant Group Availability (m out of n)
A	MSFC	Data Server	APC Server Host	SGI Challenge L	6,150	1.50	4	10.00	5.50	1	2	standby off-line	0.9991065	1.0	0.9999999
A	MSFC	Data Server	APC RAID (35GB, host attached)	SGI RAID 5	500,000	1.50	4	N/A	5.50	1	1	N/A	0.9999890	N/A	0.9999890
A	MSFC	Data Server	DIP Server Host (256MB, 6GB)	Sun Sparc 20/712	6,150	1.50	4	15.00	5.50	1	2	standby off-line	0.9991065	1.0	0.9999998
A	MSFC	Data Server	DIP Staging Storage RAID(20GB)	SGI RAID 5	500,000	1.50	4	N/A	5.50	1	1	N/A	0.9999890	N/A	0.9999890
A	MSFC	Data Server	DIP 8mm Tape Stacker (with drives)	Exabyte EXB-210	160,000	0.25	4	5.00	4.25	1	2	standby off-line	0.9999734	1.0	1.0000000
A	MSFC	Data Server	DIP 6250 Tape Drive	SUN 6250 (X680A)	115,290	2.00	4	N/A	6.00	1	1	N/A	0.9999480	N/A	0.9999480
A	MSFC	Data Server	DIP CD ROM Drives	N/A	76,932	2.00	4	N/A	6.00	1	1	N/A	0.9999220	N/A	0.9999220
A	MSFC	Data Server	WKS RAID Disk (host attached - 40 GB)	SGI RAID 5	500,000	1.50	4	N/A	5.50	1	1	N/A	0.9999890	N/A	0.9999890
A	MSFC	Data Server	FSMS Server	SGI Challenge XL	6,150	1.50	4	15.00	5.50	1	2	standby off-line	0.9991065	1.0	0.9999998
A	MSFC	Data Server	DRP DBMS Server	SGI Challenge XL	6,150	1.50	4	15.00	5.50	1	2	standby off-line	0.9991065	1.0	0.9999998
A	MSFC	Data Server	DRP RAID Disk (host attached 10 GB)	SGI RAID 5	500,000	1.50	4	N/A	5.50	1	1	N/A	0.9999890	N/A	0.9999890
A	MSFC	Data Server	Document Server (256MB, 6GB)	SUN Sparc 20/712	6,150	1.50	4	15.00	5.50	1	2	standby off-line	0.9991065	1.0	0.9999998
A	MSFC	Data Server	Document RAID Disk (host attached 10 GB)	SGI RAID 5	500,000	1.50	4	N/A	5.50	1	1	N/A	0.9999890	N/A	0.9999890
A	MSFC	Data Server	DRP Archive Robot	Bosch AMASS EML/2	23,237	1.00	4	N/A	5.00	1	1	N/A	0.9997849	N/A	0.9997849
A	MSFC	Data Server	DRP Linear Magnetic Drives	IBM-MagStar 3590 (NTP)	3,000	0.50	4	5.00	4.50	1	2	standby off-line	0.9985022	1.0	0.9999998
A	MSFC	LSM	MSS/CSS Server (256MB, 6GB)	HP755/125	23,900	1.00	4	5.00	5.00	1	2	standby off-line	0.9997908	1.0	1.0000000
A	MSFC	Comm. Equ	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	MSFC	Comm. Equ	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	MSFC	Comm. Equ	FDDI Switch	Atlantec Power Hub 7000	146,520	0.50	4	10.00	4.50	1	1	N/A	0.9999693	N/A	0.9999693

EOSD3920: Ao = 0.999568324
MDT = 0.480850955

EOSD 3920 Ao/MDT Analytical Results for MSFC (continued)



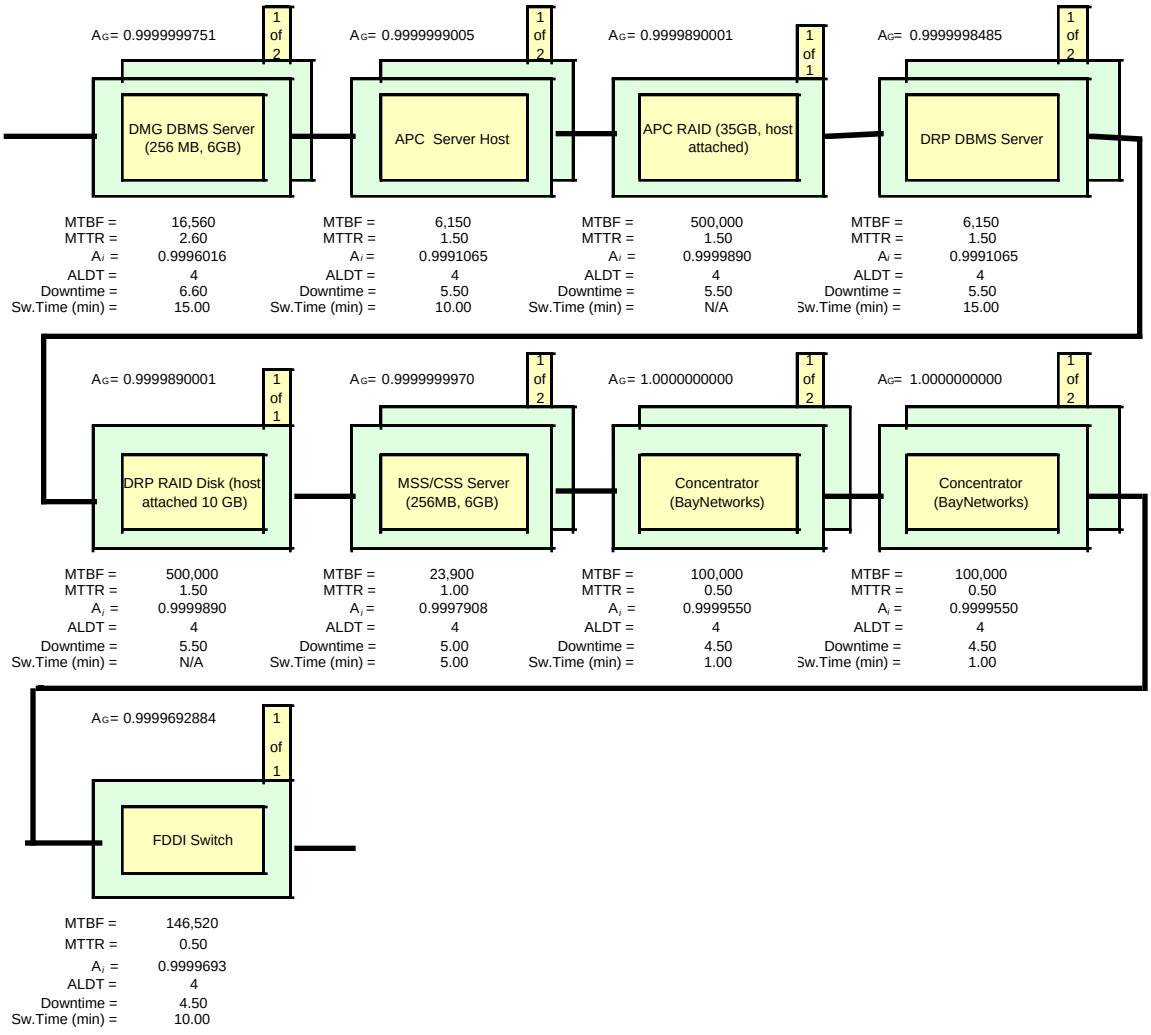
EOSD 3930 Ao/MDT Analytical Results for MSFC

EOSD3930: User Interfaces to IMS Services at Individual DAAC Site

Rel	Site	Subsys Descrip	Equipment Description	Model/Part Number	MTBF (hour)	MTTR (hour)	Admin. Logis Delay Time (hour)	Switch-over Time (min)	Total Down-time (hour)	# of Units Rqrd (m)	Total # Of Units (n)	Redundancy	Unit Availability (Ai)	P	Redundant Group Availability (m out of n)
A	MSFC	Data Manag.	DMG DBMS Server (256 MB, 6GB)	HP K200/1	16,560	2.60	4	15.00	6.60	1	2	standby off-line	0.9996016	1.0	1.0000000
A	MSFC	Data Server	APC Server Host	SGI Challenge L	6,150	1.50	4	10.00	5.50	1	2	standby off-line	0.9991065	1.0	0.9999999
A	MSFC	Data Server	APC RAID (35GB, host attached)	SGI RAID 5	500,000	1.50	4	N/A	5.50	1	1	N/A	0.9999890	N/A	0.9999890
A	MSFC	Data Server	DRP DBMS Server	SGI Challenge XL	6,150	1.50	4	15.00	5.50	1	2	standby off-line	0.9991065	1.0	0.9999998
A	MSFC	Data Server	DRP RAID Disk (host attached 10 GB)	SGI RAID 5	500,000	1.50	4	N/A	5.50	1	1	N/A	0.9999890	N/A	0.9999890
A	MSFC	LSM	MSS/CSS Server (256MB, 6GB)	HP755/125	23,900	1.00	4	5.00	5.00	1	2	standby off-line	0.9997908	1.0	1.0000000
A	MSFC	ISS	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	MSFC	ISS	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	MSFC	ISS	FDDI Switch	Atlantec Power Hub 7000	146,520	0.50	4	10.00	4.50	1	1	N/A	0.9999693	N/A	0.9999693

EOSD3930: Ao = 0.999947011
MDT = 0.239614852

EOSD 3930 Ao/MDT Analytical Results for MSFC (continued)

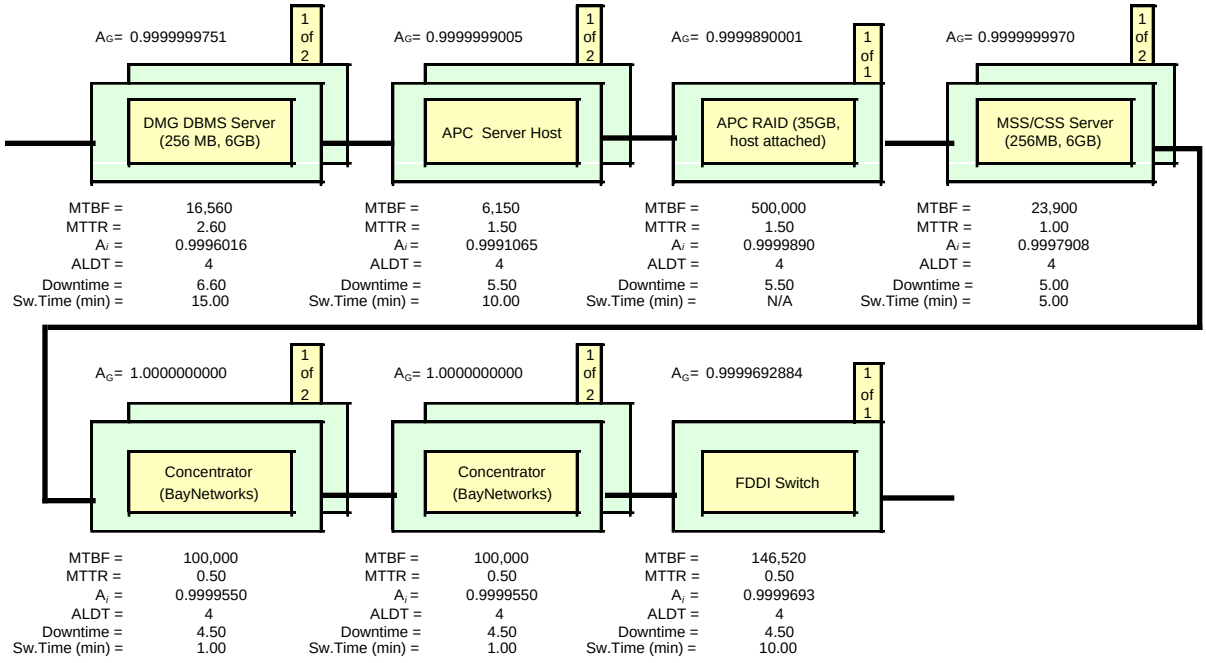


EOSD 3940 Ao/MDT Analytical Results for MSFC

EOSD3940: Function Of Information Searches On The ECS Directory

Rel	Site	Subsys Descrip	Equipment Description	Model/Part Number	MTBF (hour)	MTTR (hour)	Admin Logis Delay Time (hour)	Switch-over Time (min)	Total Down-time (hour)	# of Units Rqrd (m)	Total # Of Units (n)	Redundancy	Unit Availability (Ai)	P	Redundant Group Availability (m out of n)
A	MSFC	Data Manag.	DMG DBMS Server (256 MB, 6GB)	HP K200/1	16,560	2.60	4	15.00	6.60	1	2	standby off-line	0.9996016	1.0	1.0000000
A	MSFC	Data Server	APC Server Host	SGI Challenge L	6,150	1.50	4	10.00	5.50	1	2	standby off-line	0.9991065	1.0	0.9999999
A	MSFC	Data Server	APC RAID (35GB, host attached)	SGI RAID 5	500,000	1.50	4	N/A	5.50	1	1	N/A	0.9999890	N/A	0.9999890
A	MSFC	LSM	MSS/CSS Server (256MB, 6GB)	HP755/125	23,900	1.00	4	5.00	5.00	1	2	standby off-line	0.9997908	1.0	1.0000000
A	MSFC	ISS	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	MSFC	ISS	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	MSFC	ISS	FDDI Switch	Atlantec Power Hub 7000	146,520	0.50	4	10.00	4.50	1	1	N/A	0.9999693	N/A	0.9999693

EOSD3940: Ao = 0.999958161
MDT = 0.198037324



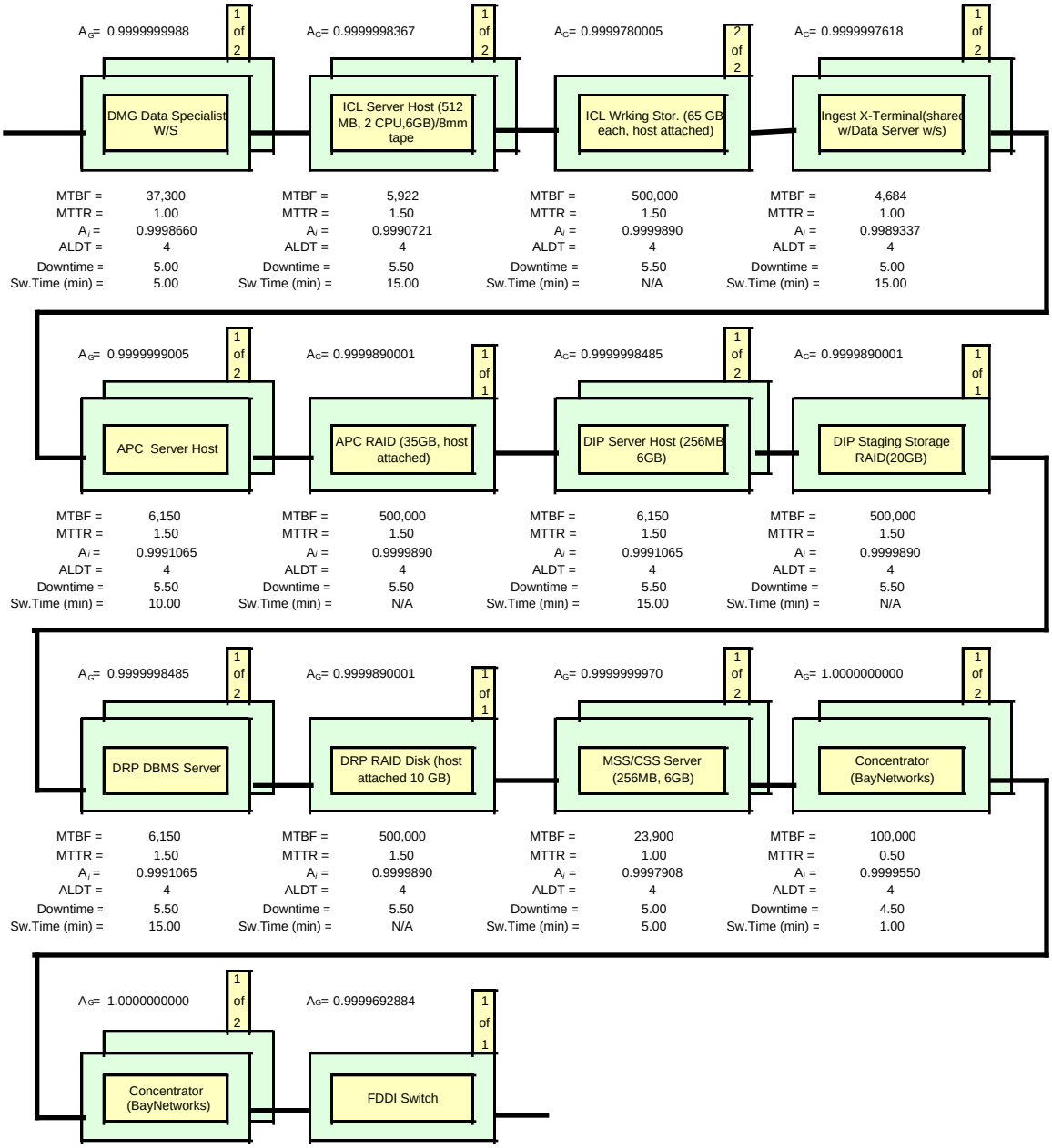
EOSD 3960 Ao/MDT Analytical Results for MSFC

EOSD3960: Function Of MetaData Ingest and Update

Rel	Site	Subsys Descrip	Equipment Description	Model/Part Number	MTBF (hour)	MTTR (hour)	Admin Logis Delay Time (hour)	Switch-over Time (min)	Total Down-time (hour)	# of Units Rqrd (m)	Total # Of Units (n)	Redundancy	Unit Availability (Ai)	P	Redundant Group Availability (m out of n)
A	MSFC	Data Manag.	DMG Data Specialist W/S	Sun Sparc 20/50	37,300	1.00	4	5.00	5.00	1	2	standby off-line	0.9998660	1.0	1.0000000
A	MSFC	Ingest	ICL Server Host (512 MB, 2 CPU,6GB)/8mm tape	SGI Challenge L/Exabyte	5,922	1.50	4	15.00	5.50	1	2	standby off-line	0.9990721	1.0	0.9999998
A	MSFC	Ingest	ICL Wrking Stor. (65 GB each, host attached)	SGI RAID 5	500,000	1.50	4	N/A	5.50	2	2	N/A	0.9999890	N/A	0.9999780
A	MSFC	Ingest	Ingest X-Terminal(shared w/Data Server w/s)	NCD Xterm	4,684	1.00	4	15.00	5.00	1	2	standby off-line	0.9989337	1.0	0.9999998
A	MSFC	Data Server	APC Server Host	SGI Challenge L	6,150	1.50	4	10.00	5.50	1	2	standby off-line	0.9991065	1.0	0.9999999
A	MSFC	Data Server	APC RAID (35GB, host attached)	SGI RAID 5	500,000	1.50	4	N/A	5.50	1	1	N/A	0.9999890	N/A	0.9999890
A	MSFC	Data Server	DIP Server Host (256MB, 6GB)	Sun Sparc 20/712	6,150	1.50	4	15.00	5.50	1	2	standby off-line	0.9991065	1.0	0.9999998
A	MSFC	Data Server	DIP Staging Storage RAID(20GB)	SGI RAID 5	500,000	1.50	4	N/A	5.50	1	1	N/A	0.9999890	N/A	0.9999890
A	MSFC	Data Server	DRP DBMS Server	SGI Challenge XL	6,150	1.50	4	15.00	5.50	1	2	standby off-line	0.9991065	1.0	0.9999998
A	MSFC	Data Server	DRP RAID Disk (host attached 10 GB)	SGI RAID 5	500,000	1.50	4	N/A	5.50	1	1	N/A	0.9999890	N/A	0.9999890
A	MSFC	LSM	MSS/CSS Server (256MB, 6GB)	HP755/125	23,900	1.00	4	5.00	5.00	1	2	standby off-line	0.9997908	1.0	1.0000000
A	MSFC	ISS	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	MSFC	ISS	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	MSFC	ISS	FDDI Switch	Atlantec Power Hub 7000	146,520	0.50	4	10.00	4.50	1	1	N/A	0.9999693	N/A	0.9999693

EOSD3960: Ao = 0.999913484
MDT = 0.262091461

EOSD 3960 Ao/MDT Analytical Results for MSFC (continued)

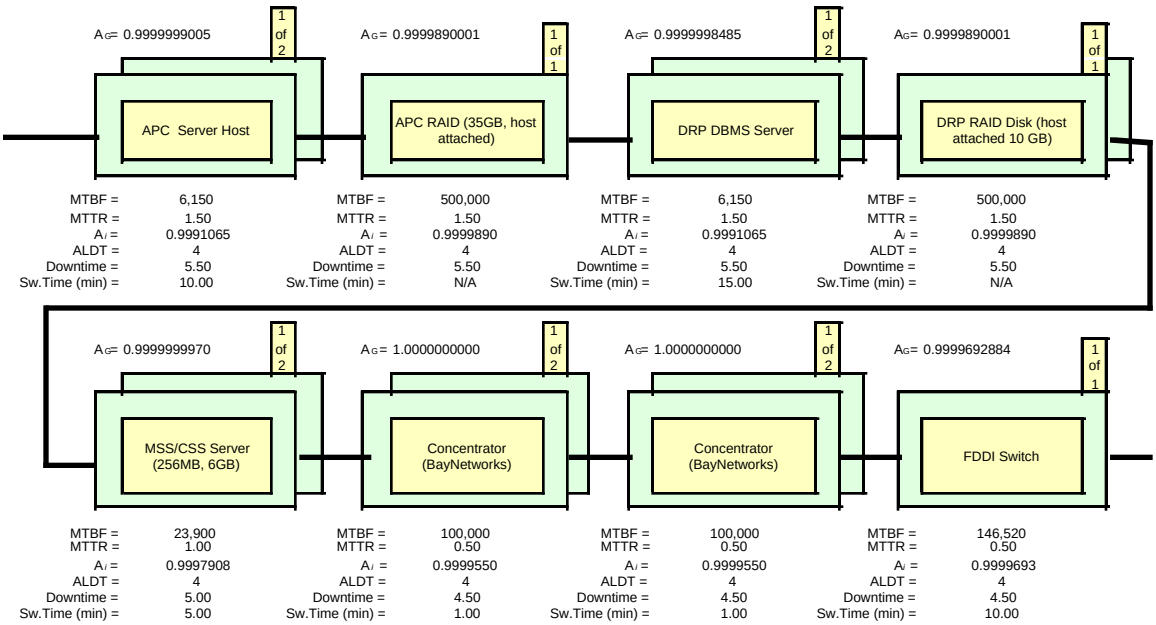


EOSD 3970 Ao/MDT Analytical Results for MSFC

EOSD3970: Function Of Info. Searches On Local Holdings

Rel	Site	Subsys Descrip	Equipment Description	Model/Part Number	MTBF (hour)	MTTR (hour)	Admin Logis Delay Time (hour)	Switch-over Time (min)	Total Down-time (hour)	# of Units Rqrd (m)	Total # Of Units (n)	Redundancy	Unit Availability (Ai)	P	Redundant Group Availability (m out of n)
A	MSFC	Data Server	APC Server Host	SGI Challenge L	6,150	1.50	4	10.00	5.50	1	2	standby off-line	0.9991065	1.0	0.9999999
A	MSFC	Data Server	APC RAID (35GB, host attached)	SGI RAID 5	500,000	1.50	4	N/A	5.50	1	1	N/A	0.9999890	N/A	0.9999890
A	MSFC	Data Server	DRP DBMS Server	SGI Challenge XL	6,150	1.50	4	15.00	5.50	1	2	standby off-line	0.9991065	1.0	0.9999998
A	MSFC	Data Server	DRP RAID Disk (host attached 10 GB)	SGI RAID 5	500,000	1.50	4	N/A	5.50	1	1	N/A	0.9999890	N/A	0.9999890
A	MSFC	LSM	MSS/CSS Server (256MB, 6GB)	HP755/125	23,900	1.00	4	5.00	5.00	1	2	standby off-line	0.9997908	1.0	1.0000000
A	MSFC	ISS	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	MSFC	ISS	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	MSFC	ISS	FDDI Switch	Atlantec Power Hub 7000	146,520	0.50	4	10.00	4.50	1	1	N/A	0.9999693	N/A	0.9999693

EOSD3970: Ao = 0.999947035
MDT = 0.23803865

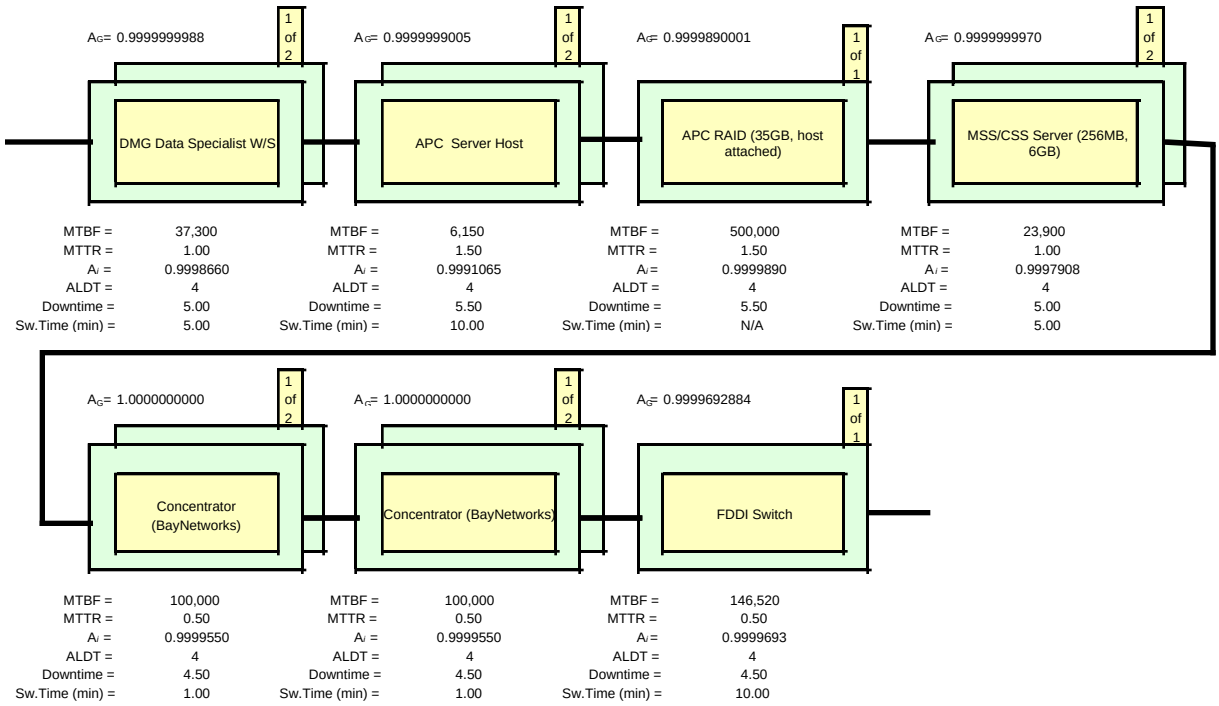


EOSD 3980 Ao/MDT Analytical Results for MSFC

EOSD3980: Function Of Local Data Order Submission

Rel	Site	Subsys Descrip	Equipment Description	Model/Part Number	MTBF (hour)	MTTR (hour)	Admin Logis Delay Time (hour)	Switch-over Time (min)	Total Down-time (hour)	# of Units Rqrd (m)	Total # Of Units (n)	Redundancy	Unit Availability (Ai)	P	Redundant Group Availability (m out of n)
A	MSFC	Data Manag.	DMG Data Specialist W/S	Sun Sparc 20/50	37,300	1.00	4	5.00	5.00	1	2	standby off-line	0.9998660	1.0	1.0000000
A	MSFC	Data Server	APC Server Host	SGI Challenge L	6,150	1.50	4	10.00	5.50	1	2	standby off-line	0.9991065	1.0	0.9999999
A	MSFC	Data Server	APC RAID (35GB, host attached)	SGI RAID 5	500,000	1.50	4	N/A	5.50	1	1	N/A	0.9999890	N/A	0.9999890
A	MSFC	LSM	MSS/CSS Server (256MB, 6GB)	HP755/125	23,900	1.00	4	5.00	5.00	1	2	standby off-line	0.9997908	1.0	1.0000000
A	MSFC	ISS	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	MSFC	ISS	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	MSFC	ISS	FDDI Switch	Atlantec Power Hub 7000	146,520	0.50	4	10.00	4.50	1	1	N/A	0.9999693	N/A	0.9999693

EOSD3980: Ao = 0.999958185
MDT = 0.174148207

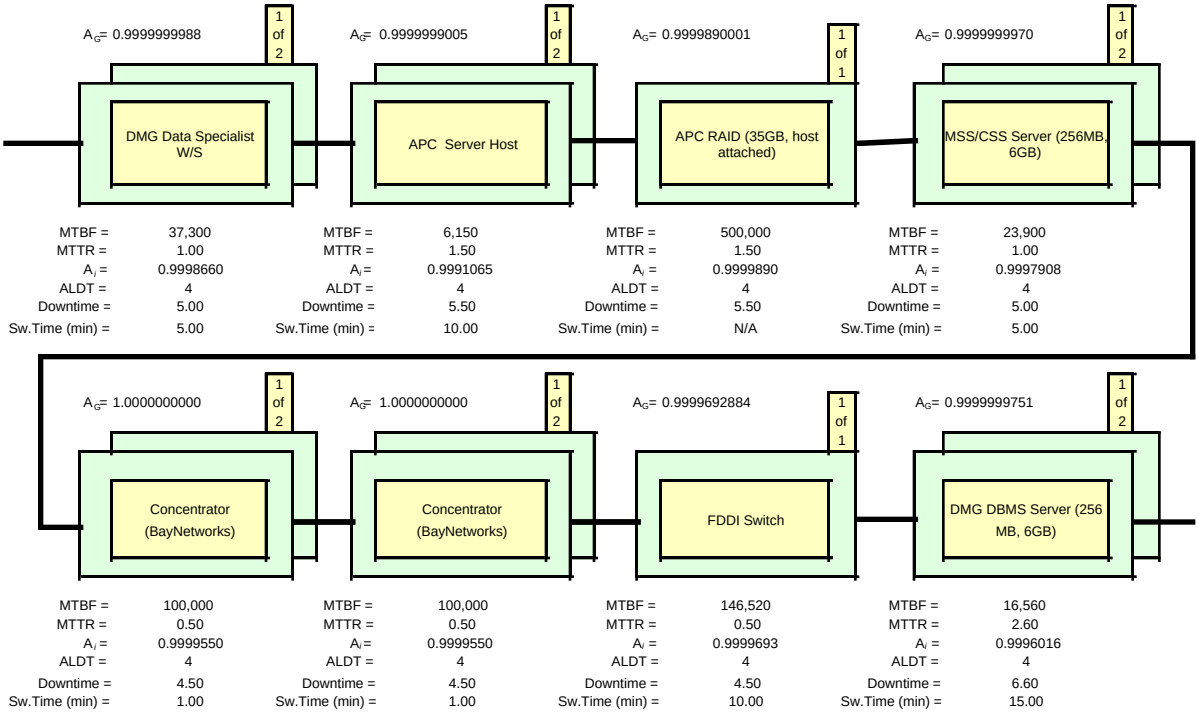


EOSD 3990 Ao/MDT Analytical Results for MSFC

EOSD3990: Function Of Data Order Submission Across DAACs

Rel	Site	Subsys Descrip	Equipment Description	Model/Part Number	MTBF (hour)	MTTR (hour)	Admin Logis Delay Time (hour)	Switch-over Time (min)	Total Down-time (hour)	# of Units Rqrd (m)	Total # Of Units (n)	Redundancy	Unit Availability (Ai)	P	Redundant Group Availability (m out of n)
A	MSFC	Data Manag.	DMG DBMS Server (256 MB, 6GB)	HP K200/1	16,560	2.60	4	15.00	6.60	1	2	standby off-line	0.9996016	1.0	1.0000000
A	MSFC	Data Manag.	DMG Data Specialist W/S	Sun Sparc 20/50	37,300	1.00	4	5.00	5.00	1	2	standby off-line	0.9998660	1.0	1.0000000
A	MSFC	Data Server	APC Server Host	SGI Challenge L	6,150	1.50	4	10.00	5.50	1	2	standby off-line	0.9991065	1.0	0.9999999
A	MSFC	Data Server	APC RAID (35GB, host attached)	SGI RAID 5	500,000	1.50	4	N/A	5.50	1	1	N/A	0.9999890	N/A	0.9999890
A	MSFC	LSM	MSS/CSS Server (256MB, 6GB)	HP755/125	23,900	1.00	4	5.00	5.00	1	2	standby off-line	0.9997908	1.0	1.0000000
A	MSFC	ISS	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	MSFC	ISS	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	MSFC	ISS	FDDI Switch	Atlantec Power Hub 7000	146,520	0.50	4	10.00	4.50	1	1	N/A	0.9999693	N/A	0.9999693

EOSD3990: Ao = 0.99995816
MDT = 0.188441312


A_G= 0.9999999988
1 of 2
DMG Data Specialist W/S
MTBF = 37,300
MTTR = 1.00
A_i = 0.9998660
ALDT = 4
Downtime = 5.00
Sw.Time (min) = 5.00
A_G= 0.9999999005
1 of 2
APC Server Host
MTBF = 6,150
MTTR = 1.50
A_i = 0.9991065
ALDT = 4
Downtime = 5.50
Sw.Time (min) = 10.00
A_G= 0.9999890001
1 of 1
APC RAID (35GB, host attached)
MTBF = 500,000
MTTR = 1.50
A_i = 0.9999890
ALDT = 4
Downtime = 5.50
Sw.Time (min) = N/A
A_G= 0.9999999970
1 of 2
MSS/CSS Server (256MB, 6GB)
MTBF = 23,900
MTTR = 1.00
A_i = 0.9997908
ALDT = 4
Downtime = 5.00
Sw.Time (min) = 5.00
A_G= 1.0000000000
1 of 2
Concentrator (BayNetworks)
MTBF = 100,000
MTTR = 0.50
A_i = 0.9999550
ALDT = 4
Downtime = 4.50
Sw.Time (min) = 1.00
A_G= 1.0000000000
1 of 2
Concentrator (BayNetworks)
MTBF = 100,000
MTTR = 0.50
A_i = 0.9999550
ALDT = 4
Downtime = 4.50
Sw.Time (min) = 1.00
A_G= 0.9999692884
1 of 1
FDDI Switch
MTBF = 146,520
MTTR = 0.50
A_i = 0.9999693
ALDT = 4
Downtime = 4.50
Sw.Time (min) = 10.00
A_G= 0.9999999751
1 of 2
DMG DBMS Server (256 MB, 6GB)
MTBF = 16,560
MTTR = 2.60
A_i = 0.9996016
ALDT = 4
Downtime = 6.60
Sw.Time (min) = 15.00

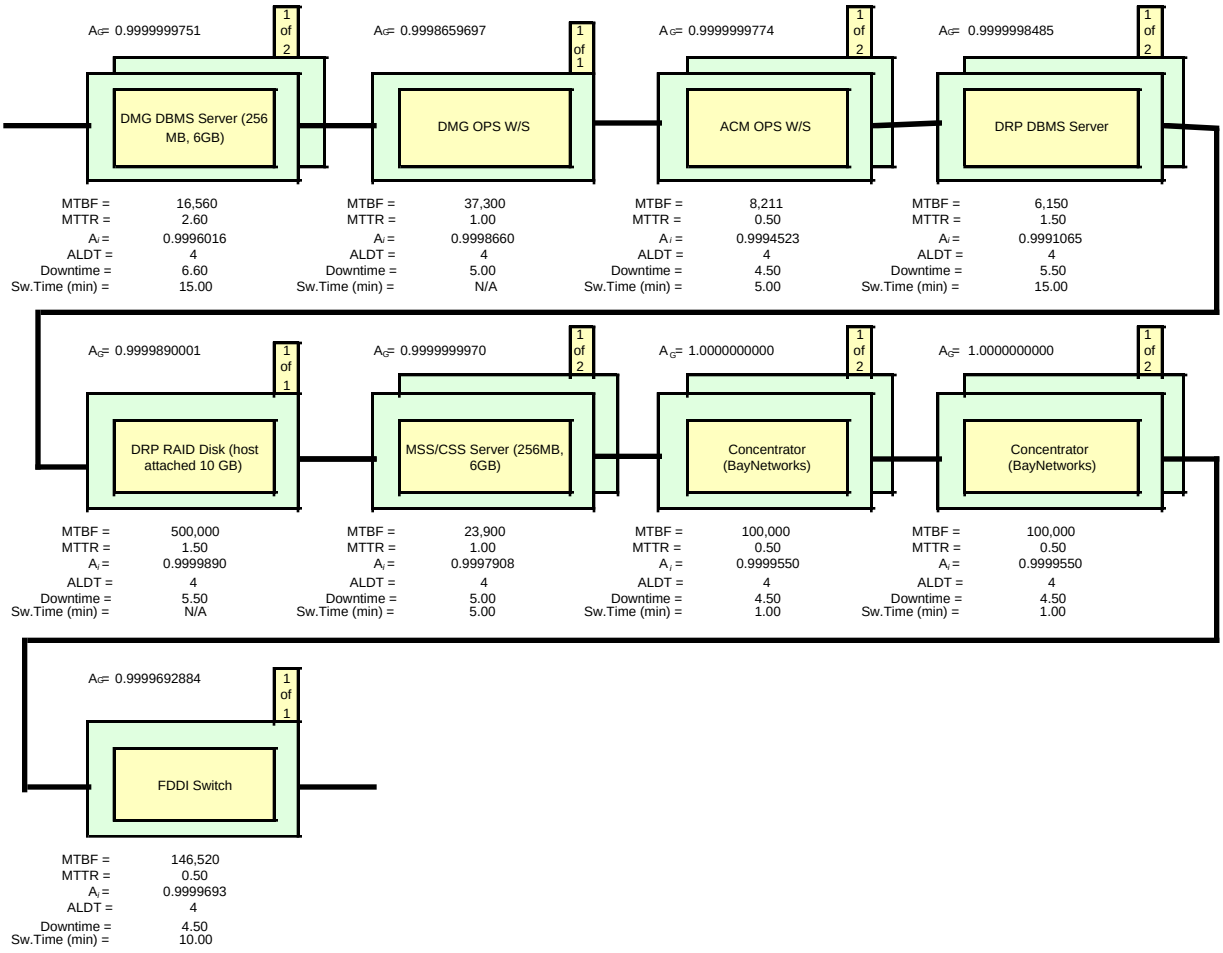
EOSD 4000 Ao/MDT Analytical Results for MSFC

EOSD4000: Function Of IMS Data Management and Maintenance Interface

Rel	Site	Subsys Descrip	Equipment Description	Model/Part Number	MTBF (hour)	MTTR (hour)	Admin Logis Delay Time (hour)	Switch-over Time (min)	Total Down-time (hour)	# of Units Rqrd (m)	Total # Of Units (n)	Redundancy	Unit Availability (Ai)	P	Redundant Group Availability (m out of n)
A	MSFC	Data Manag.	DMG DBMS Server (256 MB, 6GB)	HP K200/1	16,560	2.60	4	15.00	6.60	1	2	standby off-line	0.9996016	1.0	1.0000000
A	MSFC	Data Manag.	DMG OPS W/S	HP 715/64	37,300	1.00	4	N/A	5.00	1	1	N/A	0.9998660	N/A	0.9998660
A	MSFC	Data Server	ACM OPS W/S	Sun Sparc 20/50	8,211	0.50	4	5.00	4.50	1	2	standby off-line	0.9994523	1.0	1.0000000
A	MSFC	Data Server	DRP DBMS Server	SGI Challenge XL	6,150	1.50	4	15.00	5.50	1	2	standby off-line	0.9991065	1.0	0.9999998
A	MSFC	Data Server	DRP RAID Disk (host attached 10 GB)	SGI RAID 5	500,000	1.50	4	N/A	5.50	1	1	N/A	0.9999890	N/A	0.9999890
A	MSFC	LSM	MSS/CSS Server (256MB, 6GB)	HP755/125	23,900	1.00	4	5.00	5.00	1	2	standby off-line	0.9997908	1.0	1.0000000
A	MSFC	ISS	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	MSFC	ISS	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	MSFC	ISS	FDDI Switch	Atlantec Power Hub 7000	146,520	0.50	4	10.00	4.50	1	1	N/A	0.9999693	N/A	0.9999693

EOSD4000: Ao = 0.999824062
MDT = 0.488187834

EOSD 4000 Ao/MDT Analytical Results for MSFC

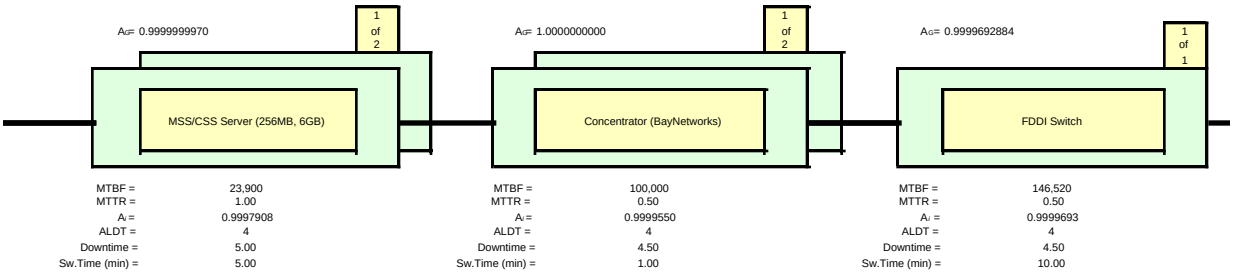


EOSD 4030 Ao/MDT Analytical Results for MSFC

EOSD4030: Function Of Gathering and Disseminating System Management Information

Rel	Site	Subsys Descrip	Equipment Description	Model/Part Number	MTBF (hour)	MTTR (hour)	Admin Logis Delay Time (hour)	Switch-over Time (min)	Total Down-time (hour)	# of Units Rqrd (m)	Total # Of Units (n)	Redundancy	Unit Availability (Ai)	P	Redundant Group Availability (m out of n)
A	MSFC	LSM	MSS/CSS Server (256MB, 6GB)	HP755/125	23,900	1.00	4	5.00	5.00	1	2	standby off-line	0.9997908	1.0	1.0000000
A	MSFC	ISS	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	MSFC	ISS	FDDI Switch	Atlantec Power Hub 7000	146,520	0.50	4	10.00	4.50	1	1	N/A	0.9999693	N/A	0.9999693

EOSD4000: Ao = 0.999969285
MDT = 0.08166429



MTBF =	23,900	MTBF =	100,000
MTTR =	1.00	MTTR =	0.50
Ai =	0.9997908	Ai =	0.9999550
ALDT =	4	ALDT =	4
Downtime =	5.00	Downtime =	4.50
Sw.Time (min) =	5.00	Sw.Time (min) =	1.00

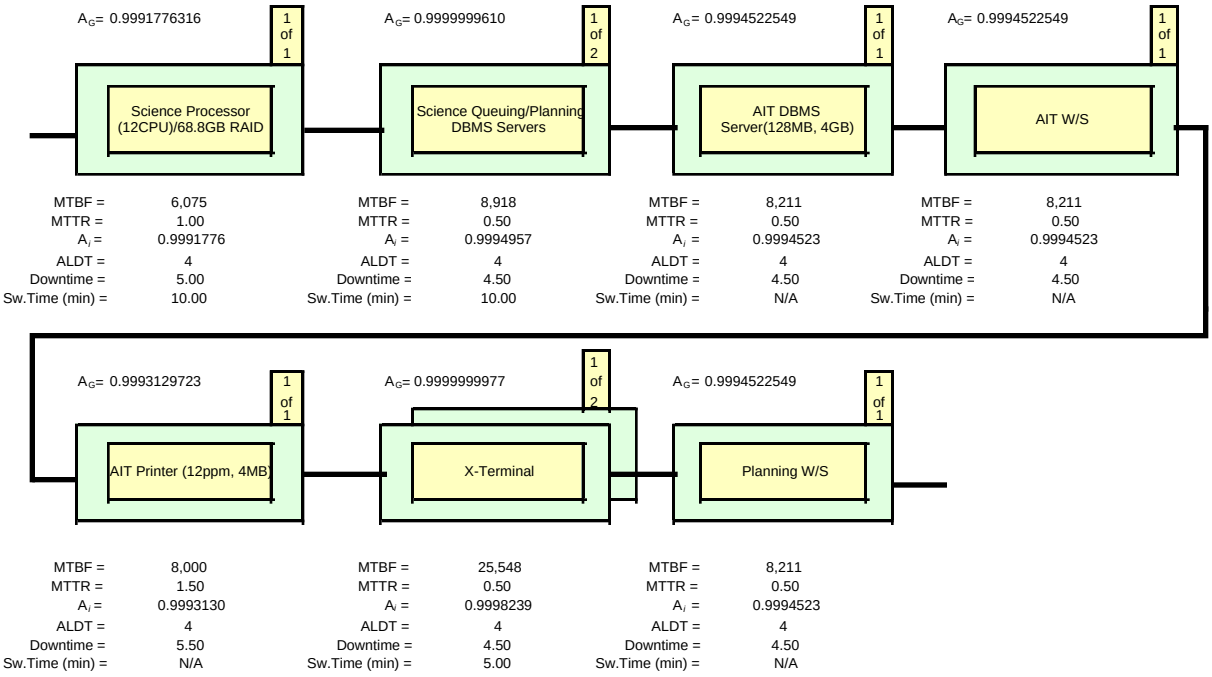
MTBF =	146,520		
MTTR =	0.50		
Ai =	0.9999693		
ALDT =	4		
Downtime =	4.50		
Sw.Time (min) =	10.00		

EOSD 3700 Ao/MDT Analytical Results for GSFC

EOSD3700: Derived Function of Planning and Data Processing

Rel	Site	Subsys Descrip	Equipment Description	Model/Part Number	MTBF (hour)	MTTR (hour)	Admin Logis Delay Time (hour)	Switch-over Time (min)	Total Down-time (hour)	# of Units Rqrd (m)	Total # Of Units (n)	Redundancy	Unit Availability (Ai)	P	Redundant Group Availability (m out of n)
A	GSFC	Science Proc,	Science Processor (12CPU)/68.8GB RAID	SGI PC XL/SGI RAID 5	6,075	1.00	4	10.00	5.00	1	1	N/A	0.9991776	N/A	0.9991776
A	GSFC	Science Proc,	Science Queuing/Planning DBMS Servers	SUN Sparc 20/71	8,918	0.50	4	10.00	4.50	1	2	standby off-line	0.9994957	1.0	1.0000000
A	GSFC	Science Proc,	AIT DBMS Server(128MB, 4GB)	SUN Sparc 20/50	8,211	0.50	4	N/A	4.50	1	1	N/A	0.9994523	N/A	0.9994523
A	GSFC	Science Proc,	AIT W/S	SUN Sparc 20/51	8,211	0.50	4	N/A	4.50	1	1	N/A	0.9994523	N/A	0.9994523
A	GSFC	Science Proc,	AIT Printer (12ppm, 4MB)	HP Laser Jet	8,000	1.50	4	N/A	5.50	1	1	N/A	0.9993130	N/A	0.9993130
A	GSFC	Planning	X-Terminal	NCD	25,548	0.50	4	5.00	4.50	1	2	standby off-line	0.9998239	1.0	1.0000000
A	GSFC	Planning	Planning W/S	SUN Sparc 20/50	8,211	0.50	4	N/A	4.50	1	1	N/A	0.9994523	N/A	0.9994523

EOSD3700: Ao = 0.99685127
MDT = 2.919186657



EOSD 3800/3810 Ao/MDT Analytical Results for GSFC

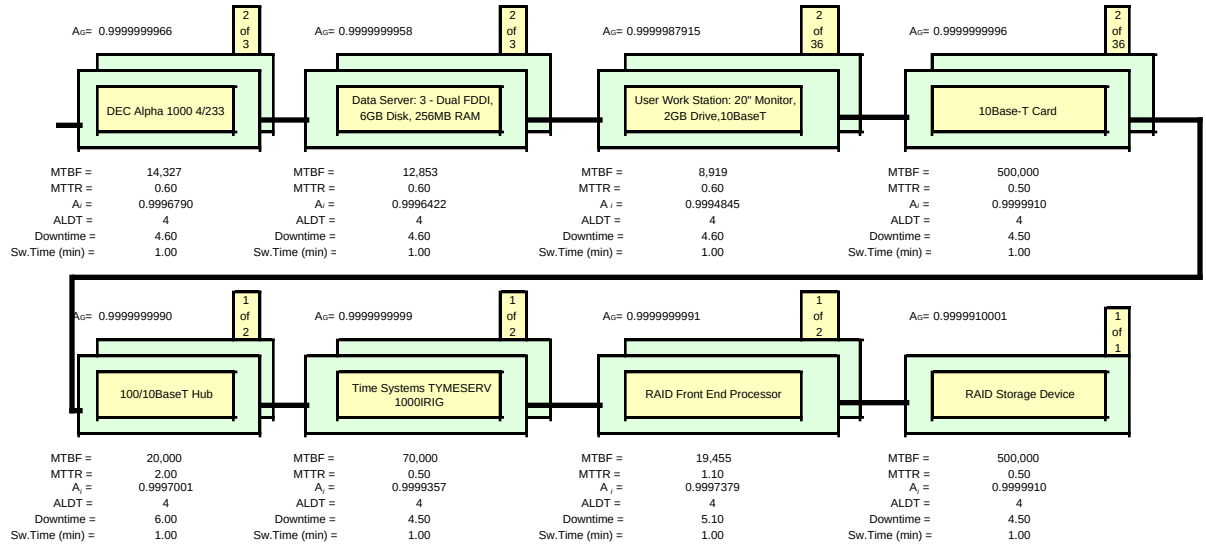
Segment: FOS

Rel	Site	Subsys Descrip	Equipment Description	Model/Part Number	MTBF (hour)	MTTR (hour)	Admin Logis Delay Time (hour)	Switch-over Time (min)	Total Down-time (hour)	# of Units Rqrd (m)	Total # Of Units (n)	Redundancy	Unit Availability (Ai)	P	Redundant Group Availability (m out of n)
A/B	GSFC	EOC	Real-Time Server: 2 - Dual FDDI, 6GB Disk, 256MB RAM	DEC Alpha 1000 4/233	14,327	0.60	4	1.0	4.60	2	3	standby off-line	0.9996790	1.0	1.0000000
A/B	GSFC	EOC	Data Server: 3 - Dual FDDI, 6GB Disk, 256MB RAM	DEC Alpha 1000 4/200	12,853	0.60	4	1.0	4.60	2	3	standby off-line	0.9996422	1.0	1.0000000
A/B	GSFC	EOC	User Work Station: 20" Monitor, 2GB Drive,10BaseT	SUN Sparc20 Model 71	8,919	0.60	4	1.0	4.60	2	36	standby off-line	0.9994845	1.0	0.9999988
A/B	GSFC	EOC	10Base-T Card	N/A	500,000	0.50	4	1.0	4.50	2	36	standby off-line	0.9999910	1.0	1.0000000
A/B	GSFC	EOC	100/10BaseT Hub	N/A	20,000	2.00	4	1.0	6.00	1	2	standby off-line	0.9997001	1.0	1.0000000
A/B	GSFC	EOC	Time Systems TYMESERV 1000IRIG	N/A	70,000	0.50	4	1.0	4.50	1	2	standby off-line	0.9999357	1.0	1.0000000
A/B	GSFC	EOC	RAID Front End Processor	DEC Alpha 1000	19,455	1.10	4	1.0	5.10	1	2	standby off-line	0.9997379	1.0	1.0000000
A/B	GSFC	EOC	RAID Storage Device	N/A	500,000	0.50	4	1.0	4.50	1	1	Internal	0.9999910	N/A	0.9999910
A/B	GSFC	EOC	Laser Printer	HP Laser Jet 4M	8,000	1.50	4	1.0	5.50	2	7	standby off-line	0.9993130	1.0	0.9999999
A/B	GSFC	EOC	Color Printer	HP Color Laser Jet	6,000	1.00	4	1.0	5.00	1	5	standby off-line	0.9991674	1.0	0.9999999

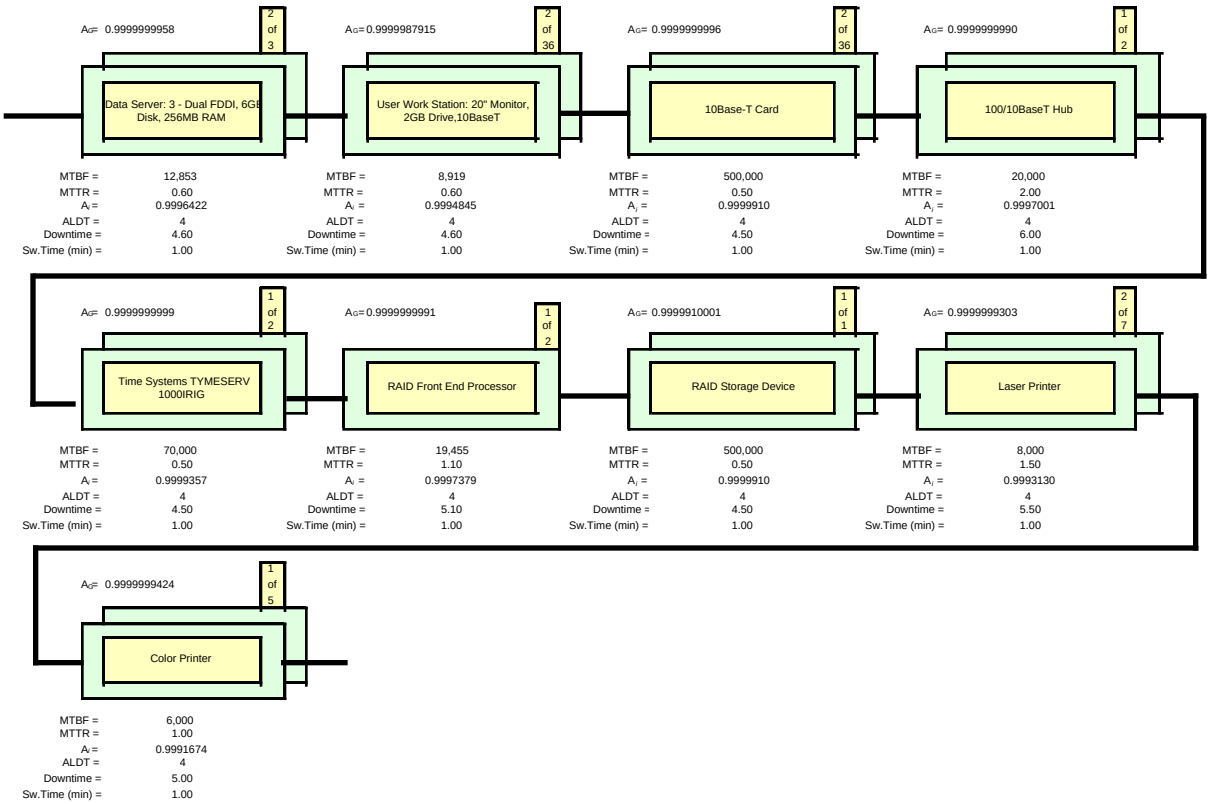
FOS Critical Real Time Availability: Ao = 0.9999897817
FOS Non-Critical R/T Availability: Ao = 0.9999896577

FOS Crit.Mean Down Time (hour): MDT= 0.017
FOS Non-Crit. MDT (hour): MDT= 0.017

EOSD 3800 Block Diagram for GSFC



EOSD 3810 Block Diagram for GSFC



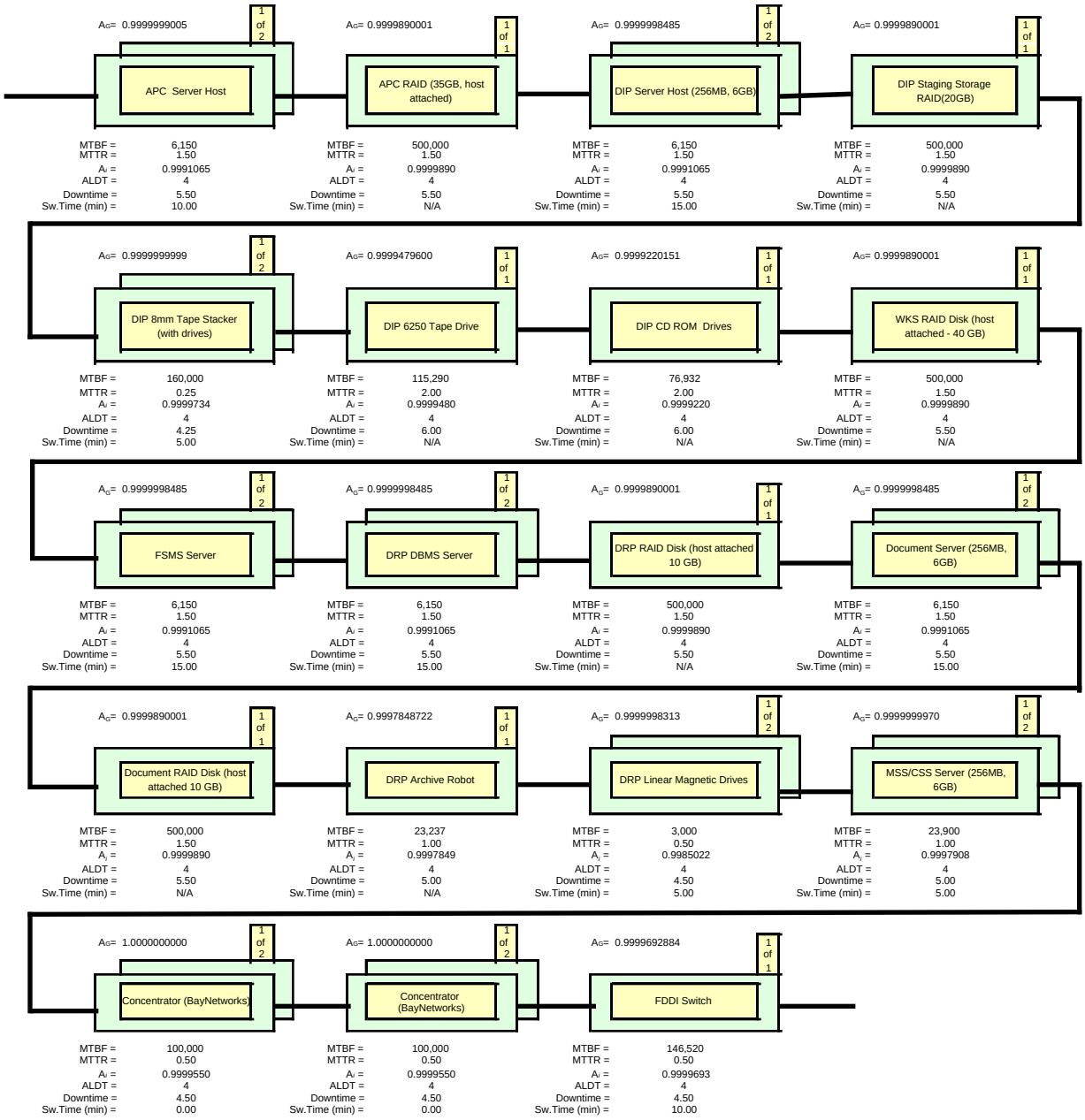
EOSD 3920 Ao/MDT Analytical Results for GSFC

EOSD3920: Function Of Archiving and Distributing Data

Rel	Site	Subsys Descrip	Equipment Description	Model/Part Number	MTBF (hour)	MTTR (hour)	Admin Logis Delay Time (hour)	Switch-over Time (min)	Total Down-time (hour)	# of Units Rqrd (m)	Total # Of Units (n)	Redundancy	Unit Availability (Ai)	P	Redundant Group Availability (m out of n)
A	GSFC	Data Server	APC Server Host	SGI Challenge L	6,150	1.50	4	10.00	5.50	1	2	standby off-line	0.9991065	1.0	0.9999999
A	GSFC	Data Server	APC RAID (35GB, host attached)	SGI RAID 5	500,000	1.50	4	N/A	5.50	1	1	N/A	0.9999890	N/A	0.9999890
A	GSFC	Data Server	DIP Server Host (256MB, 6GB)	Sun Sparc 20/712	6,150	1.50	4	15.00	5.50	1	2	standby off-line	0.9991065	1.0	0.9999998
A	GSFC	Data Server	DIP Staging Storage RAID(20GB)	SGI RAID 5	500,000	1.50	4	N/A	5.50	1	1	N/A	0.9999890	N/A	0.9999890
A	GSFC	Data Server	DIP 8mm Tape Stacker (with drives)	Exabyte EXB-210	160,000	0.25	4	5.00	4.25	1	2	standby off-line	0.9999734	1.0	1.0000000
A	GSFC	Data Server	DIP 6250 Tape Drive	SUN 6250 (X680A)	115,290	2.00	4	N/A	6.00	1	1	N/A	0.9999480	N/A	0.9999480
A	GSFC	Data Server	DIP CD ROM Drives	N/A	76,932	2.00	4	N/A	6.00	1	1	N/A	0.9999220	N/A	0.9999220
A	GSFC	Data Server	WKS RAID Disk (host attached - 40 GB)	SGI RAID 5	500,000	1.50	4	N/A	5.50	1	1	N/A	0.9999890	N/A	0.9999890
A	GSFC	Data Server	FSMS Server	SGI Challenge XL	6,150	1.50	4	15.00	5.50	1	2	standby off-line	0.9991065	1.0	0.9999998
A	GSFC	Data Server	DRP DBMS Server	SGI Challenge XL	6,150	1.50	4	15.00	5.50	1	2	standby off-line	0.9991065	1.0	0.9999998
A	GSFC	Data Server	DRP RAID Disk (host attached 10 GB)	SGI RAID 5	500,000	1.50	4	N/A	5.50	1	1	N/A	0.9999890	N/A	0.9999890
A	GSFC	Data Server	Document Server (256MB, 6GB)	SUN Sparc 20/712	6,150	1.50	4	15.00	5.50	1	2	standby off-line	0.9991065	1.0	0.9999998
A	GSFC	Data Server	Document RAID Disk (host attached 10 GB)	SGI RAID 5	500,000	1.50	4	N/A	5.50	1	1	N/A	0.9999890	N/A	0.9999890
A	GSFC	Data Server	DRP Archive Robot	Bosch AMASS EML/2	23,237	1.00	4	N/A	5.00	1	1	N/A	0.9997849	N/A	0.9997849
A	GSFC	Data Server	DRP Linear Magnetic Drives	IBM-MagStar 3590 (NTP)	3,000	0.50	4	5.00	4.50	1	2	standby off-line	0.9985022	1.0	0.9999998
A	GSFC	LSM	MSS/CSS Server (256MB, 6GB)	HP755/125	23,900	1.00	4	5.00	5.00	1	2	standby off-line	0.9997908	1.0	1.0000000
A	GSFC	Comm. Equ	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	GSFC	Comm. Equ	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	GSFC	Comm. Equ	FDDI Switch	Atlantec Power Hub 7000	146,520	0.50	4	10.00	4.50	1	1	N/A	0.9999693	N/A	0.9999693

EOSD3920: Ao = 0.999568324
MDT = 0.480850955

EOSD 3920 Ao/MDT Analytical Results for GSFC (continued)



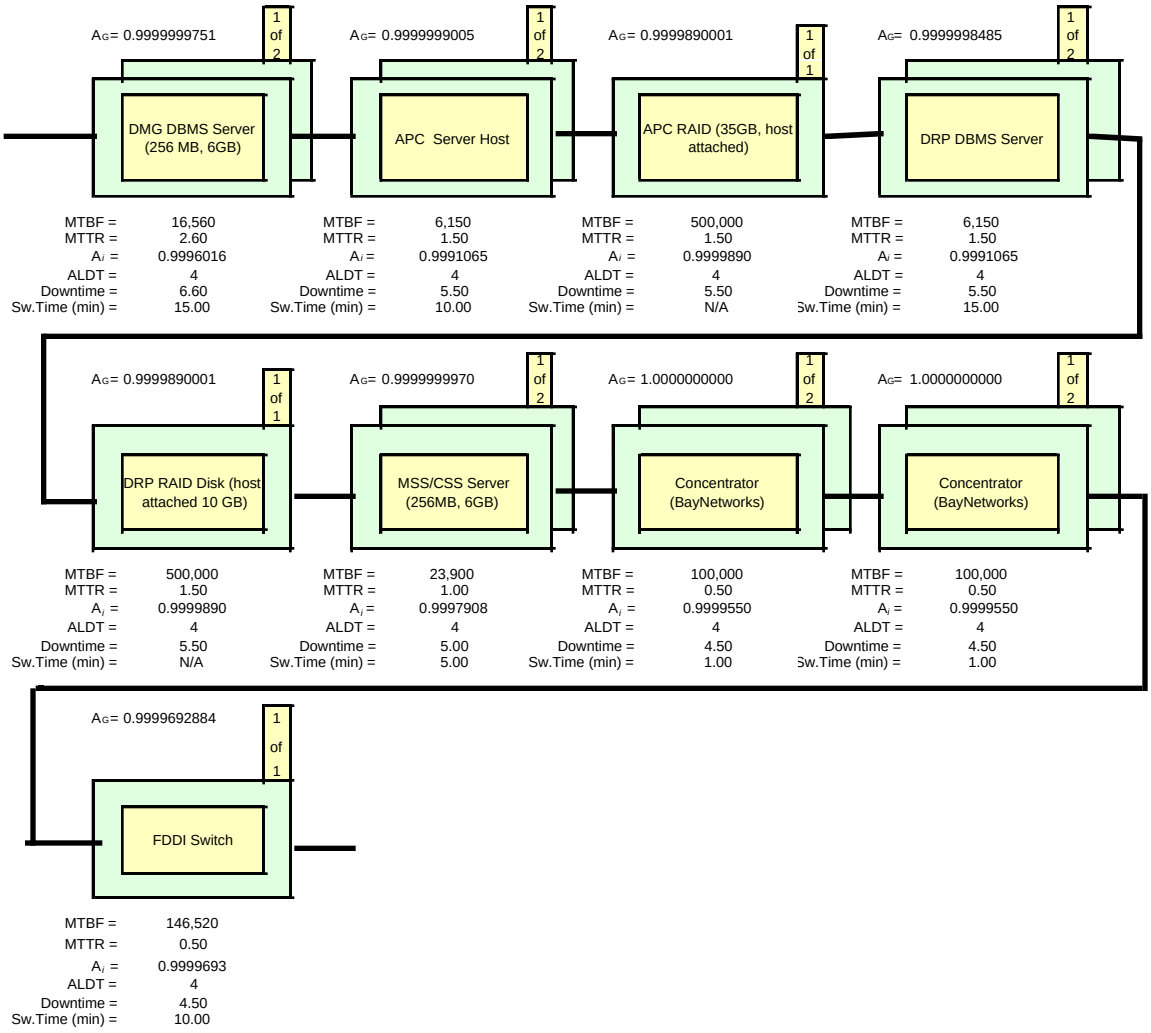
EOSD 3930 Ao/MDT Analytical Results for GSFC

EOSD3930: User Interfaces to IMS Services at Individual DAAC Site

Rel	Site	Subsys Descrip	Equipment Description	Model/Part Number	MTBF (hour)	MTTR (hour)	Admin. Logis Delay Time (hour)	Switch-over Time (min)	Total Down-time (hour)	# of Units Rqrd (m)	Total # Of Units (n)	Redundancy	Unit Availability (Ai)	P	Redundant Group Availability (m out of n)
A	GSFC	Data Manag.	DMG DBMS Server (256 MB, 6GB)	HP K200/1	16,560	2.60	4	15.00	6.60	1	2	standby off-line	0.9996016	1.0	1.0000000
A	GSFC	Data Server	APC Server Host	SGI Challenge L	6,150	1.50	4	10.00	5.50	1	2	standby off-line	0.9991065	1.0	0.9999999
A	GSFC	Data Server	APC RAID (35GB, host attached)	SGI RAID 5	500,000	1.50	4	N/A	5.50	1	1	N/A	0.9999890	N/A	0.9999890
A	GSFC	Data Server	DRP DBMS Server	SGI Challenge XL	6,150	1.50	4	15.00	5.50	1	2	standby off-line	0.9991065	1.0	0.9999998
A	GSFC	Data Server	DRP RAID Disk (host attached 10 GB)	SGI RAID 5	500,000	1.50	4	N/A	5.50	1	1	N/A	0.9999890	N/A	0.9999890
A	GSFC	LSM	MSS/CSS Server (256MB, 6GB)	HP755/125	23,900	1.00	4	5.00	5.00	1	2	standby off-line	0.9997908	1.0	1.0000000
A	GSFC	ISS	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	GSFC	ISS	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	GSFC	ISS	FDDI Switch	Atlantec Power Hub 7000	146,520	0.50	4	10.00	4.50	1	1	N/A	0.9999693	N/A	0.9999693

EOSD3930: Ao = 0.999947011
MDT = 0.239614852

EOSD 3930 Ao/MDT Analytical Results for GSFC (continued)

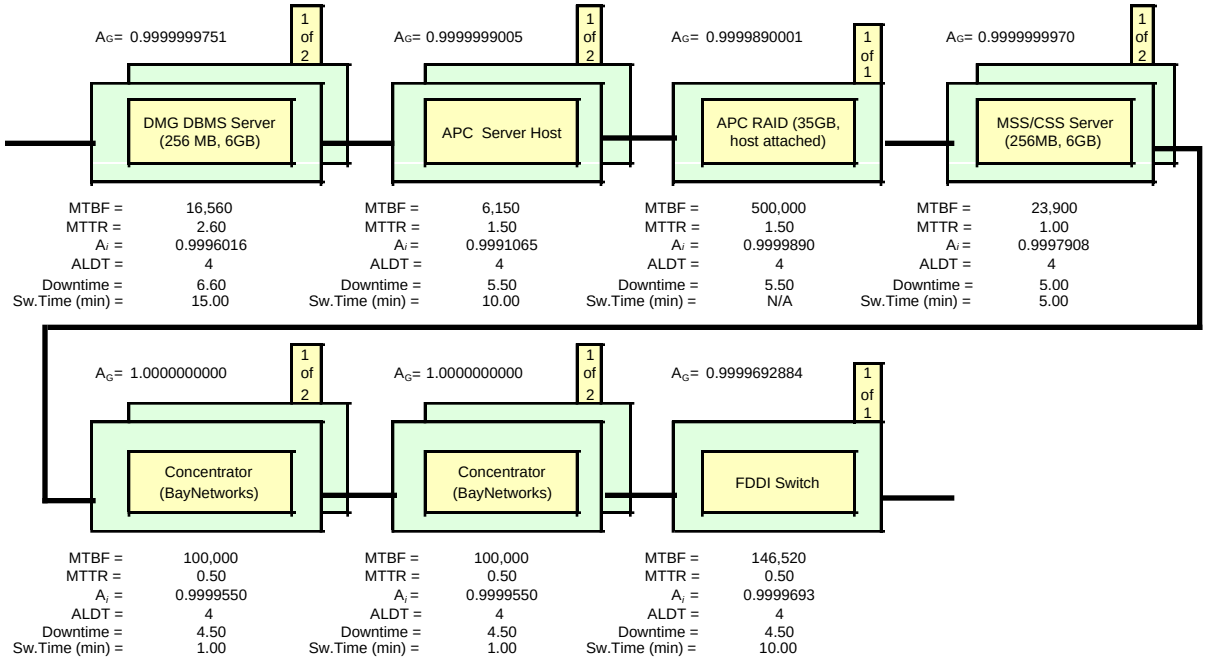


EOSD 3940 Ao/MDT Analytical Results for GSFC

EOSD3940: Function Of Information Searches On The ECS Directory

Rel	Site	Subsys Descrip	Equipment Description	Model/Part Number	MTBF (hour)	MTTR (hour)	Admin Logis Delay Time (hour)	Switch-over Time (min)	Total Down-time (hour)	# of Units Rqrd (m)	Total # Of Units (n)	Redundancy	Unit Availability (Ai)	P	Redundant Group Availability (m out of n)
A	GSFC	Data Manag.	DMG DBMS Server (256 MB, 6GB)	HP K200/1	16,560	2.60	4	15.00	6.60	1	2	standby off-line	0.9996016	1.0	1.0000000
A	GSFC	Data Server	APC Server Host	SGI Challenge L	6,150	1.50	4	10.00	5.50	1	2	standby off-line	0.9991065	1.0	0.9999999
A	GSFC	Data Server	APC RAID (35GB, host attached)	SGI RAID 5	500,000	1.50	4	N/A	5.50	1	1	N/A	0.9999890	N/A	0.9999890
A	GSFC	LSM	MSS/CSS Server (256MB, 6GB)	HP755/125	23,900	1.00	4	5.00	5.00	1	2	standby off-line	0.9997908	1.0	1.0000000
A	GSFC	ISS	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	GSFC	ISS	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	GSFC	ISS	FDDI Switch	Atlantec Power Hub 7000	146,520	0.50	4	10.00	4.50	1	1	N/A	0.9999693	N/A	0.9999693

EOSD3940: Ao = 0.999958161
MDT = 0.198037324



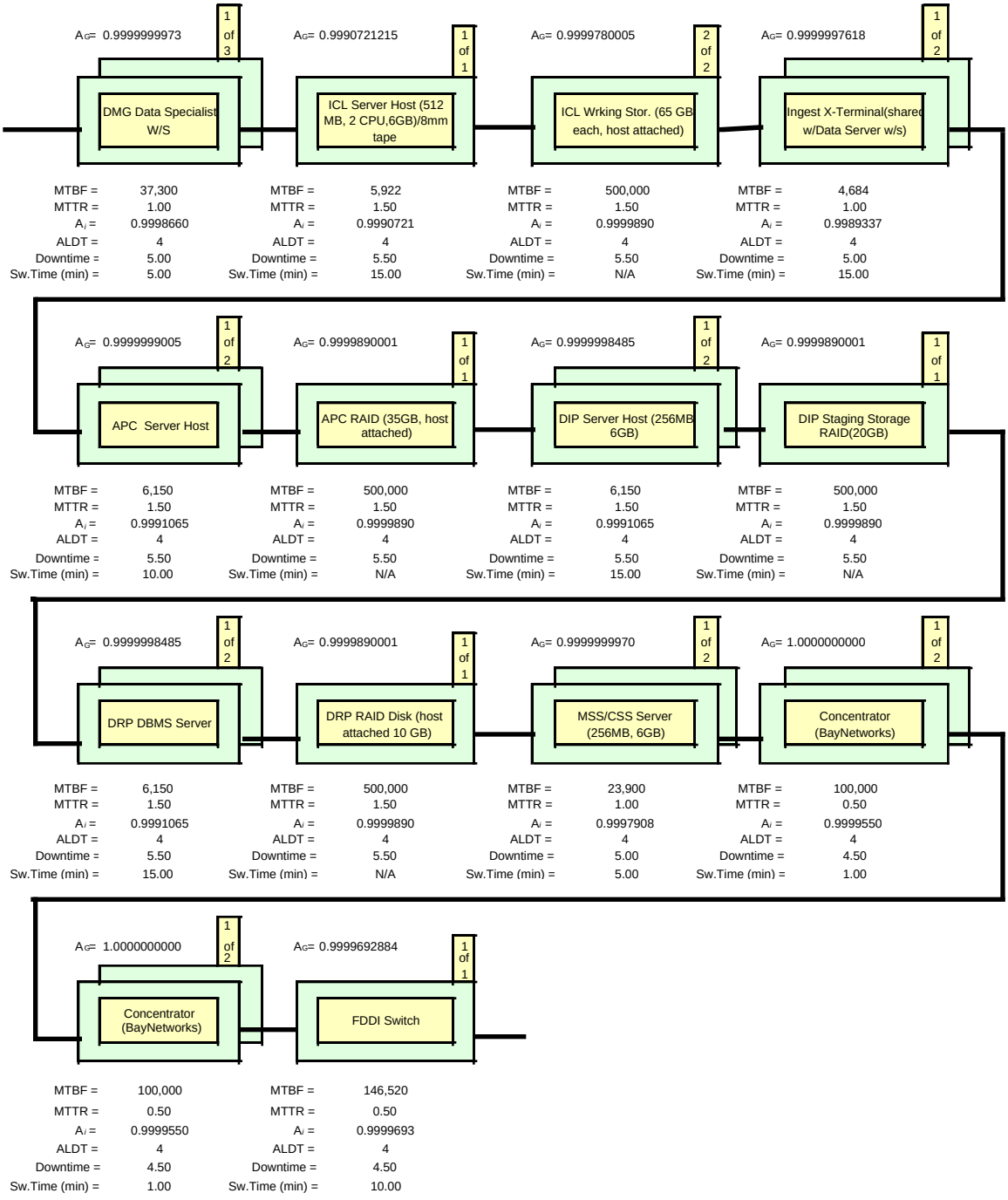
EOSD 3960 Ao/MDT Analytical Results for GSFC

EOSD3960: Function Of MetaData Ingest and Update

Rel	Site	Subsys Descrip	Equipment Description	Model/Part Number	MTBF (hour)	MTTR (hour)	Admin Logis Delay Time (hour)	Switch-over Time (min)	Total Down-time (hour)	# of Units Rqrd (m)	Total # Of Units (n)	Redundancy	Unit Availability (Ai)	P	Redundant Group Availability (m out of n)
A	LaRC	Data Manag.	DMG Data Specialist W/S	Sun Sparc 20/50	37,300	1.00	4	5.00	5.00	1	3	standby off-line	0.9998660	1.0	1.0000000
A	LaRC	Ingest	ICL Server Host (512 MB, 2 CPU,6GB)/8mm tape	SGI Challenge L/Exabyte	5,922	1.50	4	15.00	5.50	1	1	N/A	0.9990721	N/A	0.9990721
A	LaRC	Ingest	ICL Wrking Stor. (65 GB each, host attached)	SGI RAID 5	500,000	1.50	4	N/A	5.50	2	2	N/A	0.9999890	N/A	0.9999780
A	LaRC	Ingest	Ingest X-Terminal(shared w/Data Server w/s)	NCD Xterm	4,684	1.00	4	15.00	5.00	1	2	standby off-line	0.9989337	1.0	0.9999998
A	LaRC	Data Server	APC Server Host	SGI Challenge L	6,150	1.50	4	10.00	5.50	1	2	standby off-line	0.9991065	1.0	0.9999999
A	LaRC	Data Server	APC RAID (35GB, host attached)	SGI RAID 5	500,000	1.50	4	N/A	5.50	1	1	N/A	0.9999890	N/A	0.9999890
A	LaRC	Data Server	DIP Server Host (256MB, 6GB)	Sun Sparc 20/712	6,150	1.50	4	15.00	5.50	1	2	standby off-line	0.9991065	1.0	0.9999998
A	LaRC	Data Server	DIP Staging Storage RAID(20GB)	SGI RAID 5	500,000	1.50	4	N/A	5.50	1	1	N/A	0.9999890	N/A	0.9999890
A	LaRC	Data Server	DRP DBMS Server	SGI Challenge XL	6,150	1.50	4	15.00	5.50	1	2	standby off-line	0.9991065	1.0	0.9999998
A	LaRC	Data Server	DRP RAID Disk (host attached 10 GB)	SGI RAID 5	500,000	1.50	4	N/A	5.50	1	1	N/A	0.9999890	N/A	0.9999890
A	LaRC	LSM	MSS/CSS Server (256MB, 6GB)	HP755/125	23,900	1.00	4	5.00	5.00	1	2	standby off-line	0.9997908	1.0	1.0000000
A	LaRC	ISS	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	LaRC	ISS	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	LaRC	ISS	FDDI Switch	Atlantec Power Hub 7000	146,520	0.50	4	10.00	4.50	1	1	N/A	0.9999693	N/A	0.9999693

EOSD3960: Ao = 0.998985847
MDT = 1.17262229

EOSD 3960 Ao/MDT Analytical Results for GSFC (continued)

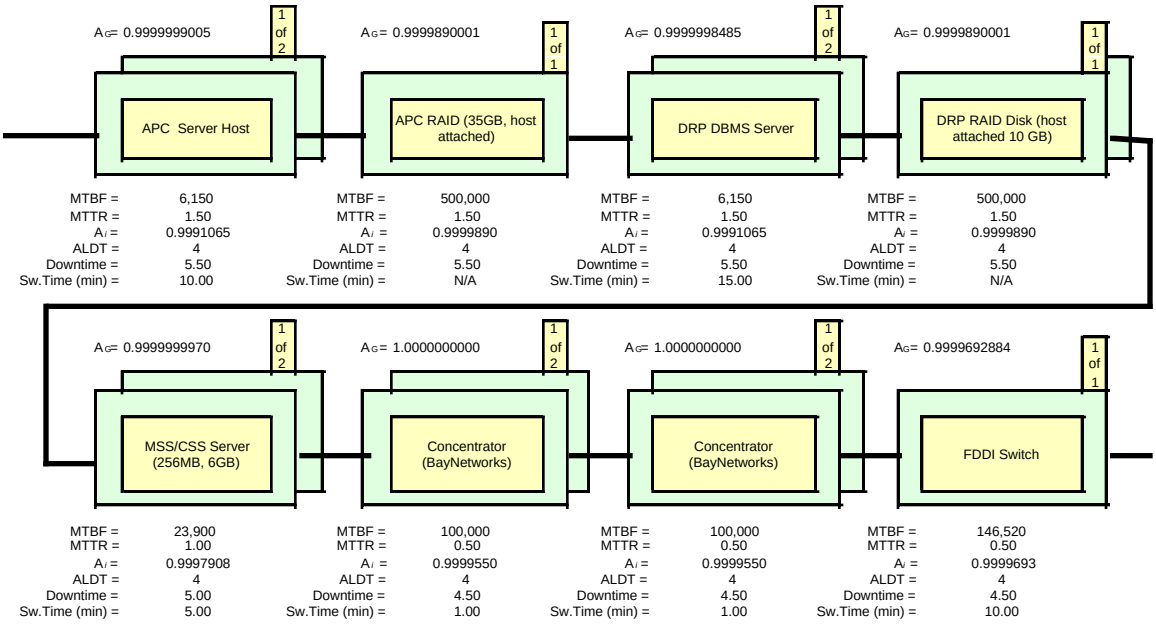


EOSD 3970 Ao/MDT Analytical Results for GSFC

EOSD3970: Function Of Info. Searches On Local Holdings

Rel	Site	Subsys Descrip	Equipment Description	Model/Part Number	MTBF (hour)	MTTR (hour)	Admin Logis Delay Time (hour)	Switch-over Time (min)	Total Down-time (hour)	# of Units Rqrd (m)	Total # Of Units (n)	Redundancy	Unit Availability (Ai)	P	Redundant Group Availability (m out of n)
A	GSFC	Data Server	APC Server Host	SGI Challenge L	6,150	1.50	4	10.00	5.50	1	2	standby off-line	0.9991065	1.0	0.9999999
A	GSFC	Data Server	APC RAID (35GB, host attached)	SGI RAID 5	500,000	1.50	4	N/A	5.50	1	1	N/A	0.9999890	N/A	0.9999890
A	GSFC	Data Server	DRP DBMS Server	SGI Challenge XL	6,150	1.50	4	15.00	5.50	1	2	standby off-line	0.9991065	1.0	0.9999998
A	GSFC	Data Server	DRP RAID Disk (host attached 10 GB)	SGI RAID 5	500,000	1.50	4	N/A	5.50	1	1	N/A	0.9999890	N/A	0.9999890
A	GSFC	LSM	MSS/CSS Server (256MB, 6GB)	HP755/125	23,900	1.00	4	5.00	5.00	1	2	standby off-line	0.9997908	1.0	1.0000000
A	GSFC	ISS	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	GSFC	ISS	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	GSFC	ISS	FDDI Switch	Atlantec Power Hub 7000	146,520	0.50	4	10.00	4.50	1	1	N/A	0.9999693	N/A	0.9999693

EOSD3970: Ao = 0.999947035
MDT = 0.23803865

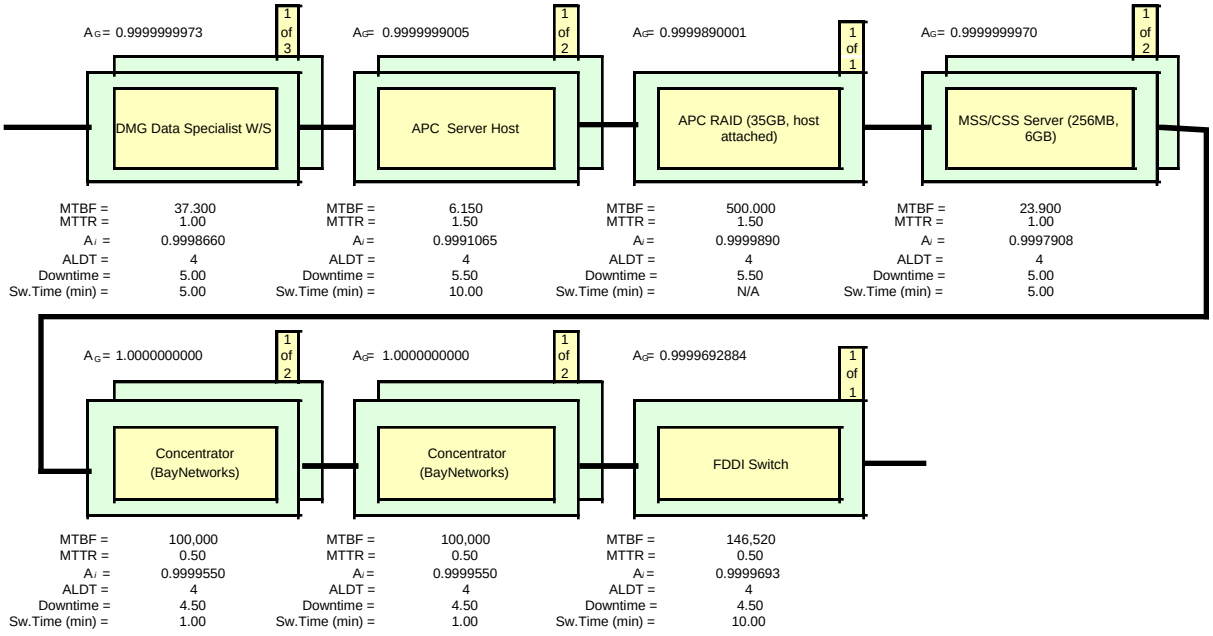


EOSD 3980 Ao/MDT Analytical Results for GSFC

EOSD3980: Function Of Local Data Order Submission

Rel	Site	Subsys Descrip	Equipment Description	Model/Part Number	MTBF (hour)	MTTR (hour)	Admin Logis Delay Time (hour)	Switch-over Time (min)	Total Down-time (hour)	# of Units Rqrd (m)	Total # Of Units (n)	Redundancy	Unit Availability (Ai)	P	Redundant Group Availability (m out of n)
A	GSFC	Data Manag.	DMG Data Specialist W/S	Sun Sparc 20/50	37,300	1.00	4	5.00	5.00	1	3	standby off-line	0.9998660	1.0	1.0000000
A	GSFC	Data Server	APC Server Host	SGI Challenge L	6,150	1.50	4	10.00	5.50	1	2	standby off-line	0.9991065	1.0	0.9999999
A	GSFC	Data Server	APC RAID (35GB, host attached)	SGI RAID 5	500,000	1.50	4	N/A	5.50	1	1	N/A	0.9999890	N/A	0.9999890
A	GSFC	LSM	MSS/CSS Server (256MB, 6GB)	HP755/125	23,900	1.00	4	5.00	5.00	1	2	standby off-line	0.9997908	1.0	1.0000000
A	GSFC	ISS	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	GSFC	ISS	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	GSFC	ISS	FDDI Switch	Atlantec Power Hub 7000	146,520	0.50	4	10.00	4.50	1	1	N/A	0.9999693	N/A	0.9999693

EOSD3980: Ao = 0.999958184
MDT = 0.174148207

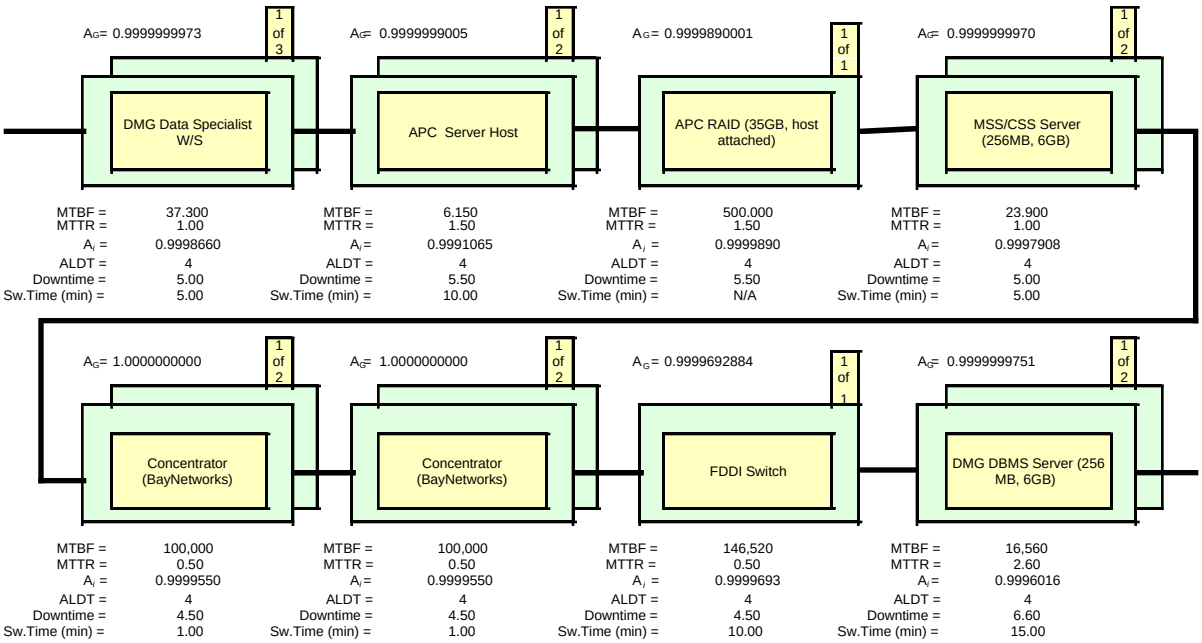


EOSD 3990 Ao/MDT Analytical Results for GSFC

EOSD3990: Function Of Data Order Submission Across DAACs

Rel	Site	Subsys Descrip	Equipment Description	Model/Part Number	MTBF (hour)	MTTR (hour)	Admin Logis Delay Time (hour)	Switch-over Time (min)	Total Down-time (hour)	# of Units Rqrd (m)	Total # Of Units (n)	Redundancy	Unit Availability (Ai)	P	Redundant Group Availability (m out of n)
A	GSFC	Data Manag.	DMG DBMS Server (256 MB, 6GB)	HP K200/1	16,560	2.60	4	15.00	6.60	1	2	standby off-line	0.9996016	1.0	1.0000000
A	GSFC	Data Manag.	DMG Data Specialist W/S	Sun Sparc 20/50	37,300	1.00	4	5.00	5.00	1	3	standby off-line	0.9998660	1.0	1.0000000
A	GSFC	Data Server	APC Server Host	SGI Challenge L	6,150	1.50	4	10.00	5.50	1	2	standby off-line	0.9991065	1.0	0.9999999
A	GSFC	Data Server	APC RAID (35GB, host attached)	SGI RAID 5	500,000	1.50	4	N/A	5.50	1	1	N/A	0.9999890	N/A	0.9999890
A	GSFC	LSM	MSS/CSS Server (256MB, 6GB)	HP755/125	23,900	1.00	4	5.00	5.00	1	2	standby off-line	0.9997908	1.0	1.0000000
A	GSFC	ISS	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	GSFC	ISS	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	GSFC	ISS	FDDI Switch	Atlantec Power Hub 7000	146,520	0.50	4	10.00	4.50	1	1	N/A	0.9999693	N/A	0.9999693

EOSD3990: Ao = 0.999958159
MDT = 0.188441312


AG= 0.9999999973
1 of 3
DMG Data Specialist W/S
MTBF = 37.300
MTTR = 1.00
Ai = 0.9998660
ALDT = 4
Downtime = 5.00
Sw.Time (min) = 5.00
AG= 0.9999999005
1 of 2
APC Server Host
MTBF = 6.150
MTTR = 1.50
Ai = 0.9991065
ALDT = 4
Downtime = 5.50
Sw.Time (min) = 10.00
AG= 0.9999890001
1 of 1
APC RAID (35GB, host attached)
MTBF = 500.000
MTTR = 1.50
Ai = 0.9999890
ALDT = 4
Downtime = 5.50
Sw.Time (min) = N/A
AG= 0.9999999970
1 of 2
MSS/CSS Server (256MB, 6GB)
MTBF = 23.900
MTTR = 1.00
Ai = 0.9997908
ALDT = 4
Downtime = 5.00
Sw.Time (min) = 5.00
AG= 1.0000000000
1 of 2
Concentrator (BayNetworks)
MTBF = 100,000
MTTR = 0.50
Ai = 0.9999550
ALDT = 4
Downtime = 4.50
Sw.Time (min) = 1.00
AG= 1.0000000000
1 of 2
Concentrator (BayNetworks)
MTBF = 100,000
MTTR = 0.50
Ai = 0.9999550
ALDT = 4
Downtime = 4.50
Sw.Time (min) = 1.00
AG= 0.9999692884
1 of 1
FDDI Switch
MTBF = 146,520
MTTR = 0.50
Ai = 0.9999693
ALDT = 4
Downtime = 4.50
Sw.Time (min) = 10.00
AG= 0.9999999751
1 of 2
DMG DBMS Server (256 MB, 6GB)
MTBF = 16,560
MTTR = 2.60
Ai = 0.9996016
ALDT = 4
Downtime = 6.60
Sw.Time (min) = 15.00

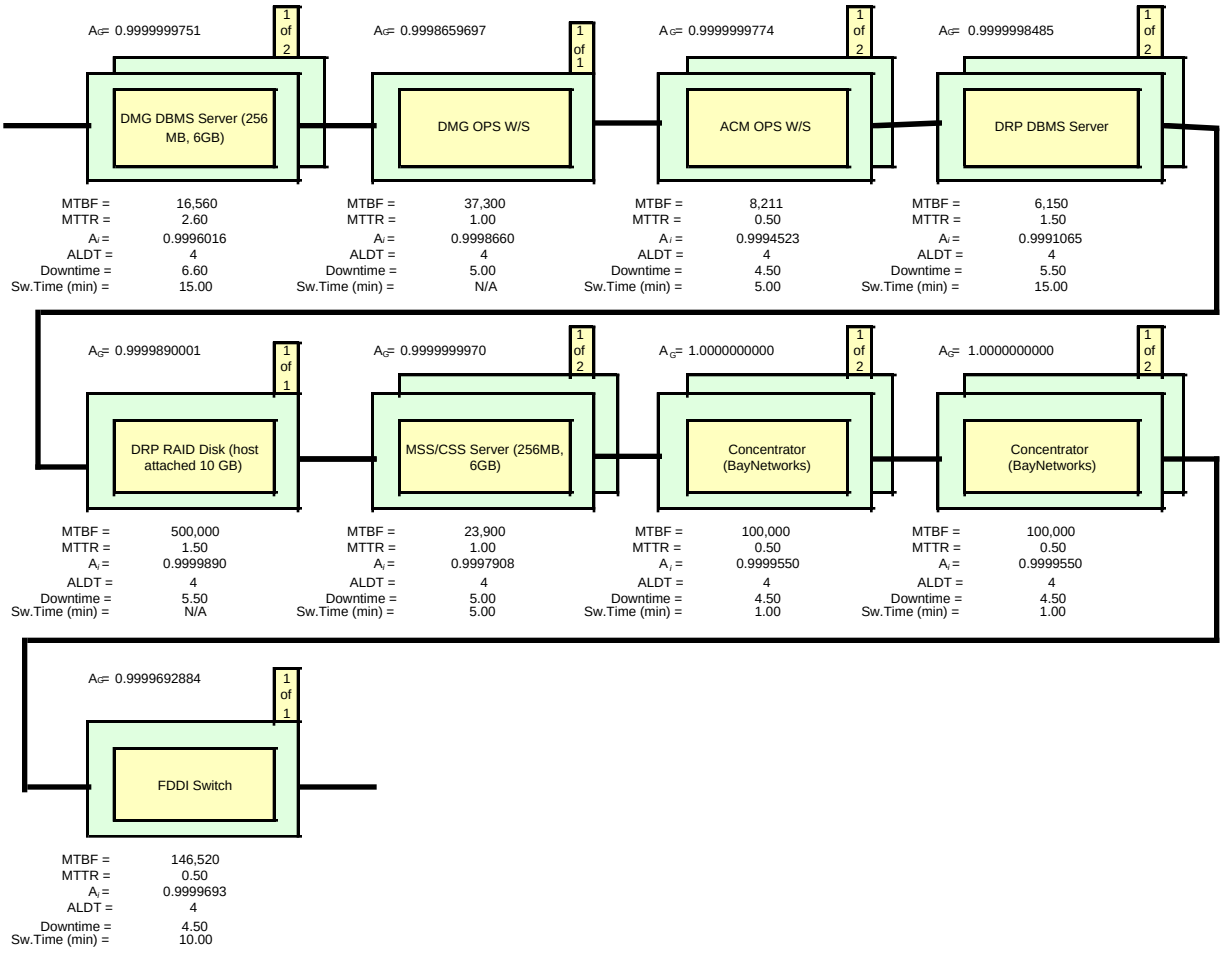
EOSD 4000 Ao/MDT Analytical Results for GSFC

EOSD4000: Function Of IMS Data Management and Maintenance Interface

Rel	Site	Subsys Descrip	Equipment Description	Model/Part Number	MTBF (hour)	MTTR (hour)	Admin Logis Delay Time (hour)	Switch-over Time (min)	Total Down-time (hour)	# of Units Rqrd (m)	Total # Of Units (n)	Redundancy	Unit Availability (Ai)	P	Redundant Group Availability (m out of n)
A	GSFC	Data Manag.	DMG DBMS Server (256 MB, 6GB)	HP K200/1	16,560	2.60	4	15.00	6.60	1	2	standby off-line	0.9996016	1.0	1.0000000
A	GSFC	Data Manag.	DMG OPS W/S	HP 715/64	37,300	1.00	4	N/A	5.00	1	1	N/A	0.9998660	N/A	0.9998660
A	GSFC	Data Server	ACM OPS W/S	Sun Sparc 20/50	8,211	0.50	4	5.00	4.50	1	2	standby off-line	0.9994523	1.0	1.0000000
A	GSFC	Data Server	DRP DBMS Server	SGI Challenge XL	6,150	1.50	4	15.00	5.50	1	2	standby off-line	0.9991065	1.0	0.9999998
A	GSFC	Data Server	DRP RAID Disk (host attached 10 GB)	SGI RAID 5	500,000	1.50	4	N/A	5.50	1	1	N/A	0.9999890	N/A	0.9999890
A	GSFC	LSM	MSS/CSS Server (256MB, 6GB)	HP755/125	23,900	1.00	4	5.00	5.00	1	2	standby off-line	0.9997908	1.0	1.0000000
A	GSFC	ISS	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	GSFC	ISS	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	GSFC	ISS	FDDI Switch	Atlantec Power Hub 7000	146,520	0.50	4	10.00	4.50	1	1	N/A	0.9999693	N/A	0.9999693

EOSD4000: Ao = 0.999824062
MDT = 0.488187834

EOSD 4000 Ao/MDT Analytical Results for GSFC

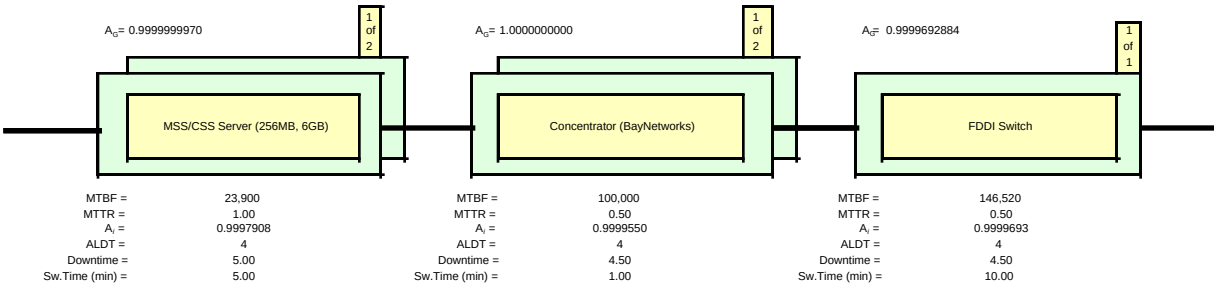


EOSD 4030 Ao/MDT Analytical Results for GSFC

EOSD4030: Function Of Gathering and Disseminating System Management Information

Rel	Site	Subsys Descrip	Equipment Description	Model/Part Number	MTBF (hour)	MTTR (hour)	Admin Logis Delay Time (hour)	Switch-over Time (min)	Total Down-time (hour)	# of Units Rqrd (m)	Total # Of Units (n)	Redundancy	Unit Availability (Ai)	P	Redundant Group Availability (m out of n)
A	GSFC	LSM	MSS/CSS Server (256MB, 6GB)	HP755/125	23,900	1.00	4	5.00	5.00	1	2	standby off-line	0.9997908	1.0	1.0000000
A	GSFC	ISS	Concentrator (BayNetworks)	Synoptics 2914-04	100,000	0.50	4	1.00	4.50	1	2	standby off-line	0.9999550	1.0	1.0000000
A	GSFC	ISS	FDDI Switch	Atlantec Power Hub 7000	146,520	0.50	4	10.00	4.50	1	1	N/A	0.9999693	N/A	0.9999693

EOSD4000: Ao = 0.999969285
MDT = 0.08166429



MTBF =	23,900	MTBF =	100,000	MTBF =	146,520
MTTR =	1.00	MTTR =	0.50	MTTR =	0.50
A_i =	0.9997908	A_i =	0.9999550	A_i =	0.9999693
ALDT =	4	ALDT =	4	ALDT =	4
Downtime =	5.00	Downtime =	4.50	Downtime =	4.50
Sw.Time (min) =	5.00	Sw.Time (min) =	1.00	Sw.Time (min) =	10.00

Abbreviations and Acronyms

A_o	Operational Avaliability
ALDT	Alternate Logistic Delay Time
APC	Access/Process Coordinators
ARAM	Automated Reliability/Availability/Maintainability
CCR	Configuration Change Request
CDR	Critical Design Review
CDRL	Contract Data Requirements List
CN	Change Notice
COTS	Commercial Off The Shelf
CSMS	Communications and Systems Management Segment (ECS)
CSS	Communications Subsystem
DAAC	Distributed Active Archive Center
DBA	Database Administrator
DBMS	Database Management System
DCHCI	Distributed Communications Hardware Configuration Item
DCN	Document Change Notice
DID	Data Item Description
DIMGR	Distributed Information Manager
DIPHW	Distribution and Ingest Peripheral HWCI
DMS	Data Management System
DR	Data Repository
ECS	EODIS Core System
EDC	EROS Data Center (DAAC)
EDOS	EOS Data and Operations System
EOC	EOS Operations Center
EOS	Earth Observing System
EOSDIS	Earth Observing System Data and Information System

EROS	Earth Resources Observation System
ESA	European Space Agency
ESDIS	Earth Science Data and Information System (GSFC)
ESN	EOSDIS Science Network
FDDI	Fiber Distributed Data Interface
FOT	Flight Operations Team
FOS	Flight Operations Segment (ECS)
FPMH	Failure Per Million Hours
GB	Giga Byte
GSFC	Goddard Space Flight Center
HD	Hard Drive
Hrs	Hours
HWCI	Hard Ware Configuration Item
IDR	Incremental Design Review
IMS	Information Management System
ISS	Internetworking Subsystem
IST	Instrument Support Terminal
LaRC	Langley Research Center (DAAC)
LIMGR	Local Information Manager
LSM	Local System Management
MB	Mega Byte
MDT	Mean Down Time
Min	Minute
MTBCM	Mean Time Between Corrective Maintenance
MTBF	Mean Time Between Failure
MTBM	Mean Time Between Maintenance
MTBPM	Mean Time Between Preventive Maintenance
MSFC	Marshall Space Flight Center
MSS	CSMS Management Subsystem
MTPE	Mission to Planet Earth
MTTR	Mean Time To Repair

NASA	National Aeronautics and Space Administration
NASDA	National Space Development Agency (Japan)
NPRD	Nonelectronic Parts Reliability Data
N/A	Not Applicable
PAIP	Performance Assurance Implementation Plan
PDR	Preliminary Design Review
PI	Principal Investigator
PI/TL	Principal Investigator/Team Leader
RMA	Reliability, Maintainability, Availability
SDPS	Science Data Processing Segment (ECS)
SMC	Service Management Center
SPSO	Science Processing Support Office
ST	Switchover Time
TBD	To Be Determnined
TL	Team Leader
WRKSTN	Workstation

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